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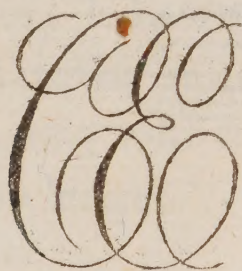
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B E N J A M I N B E L L,  
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THIS and the preceding Volumes comprehend the System of Surgery which I had undertaken to publish.

To a candid Public I am under great obligations. My labours have met with a reception more favourable than I expected, and more flattering than they seem to me to merit.

DIFFERENT editions have already been published of the preceding volumes. If the Work, now that it is finished, continues to have a similar reception, no attention shall be wanting on my part to render it as complete as may be: I mean to insert in every edition to which it may extend, whatever improvements future experience may add to our stock of chirurgical knowledge.

For this purpose, I have already requested the favour of my friends in dif-



ferent parts of the world, to give me early intelligence of every improvement with which they may become acquainted; and I take this method of soliciting the same kind of assistance from others. In this manner, I shall be enabled to render the work more perfect than I otherwise could do; at the same time that improvements may thus be preserved which otherwise might be lost.

To the purchasers of the first editions, I think it a piece of justice to observe, that their interest shall not be affected, by any improvements that may be inserted in any subsequent edition; for whenever the alterations are of much importance, the Booksellers, both here and elsewhere, shall be desired to sell them separate from the rest of the Work.

BENJAMIN BELL.

Epim. May }  
1788. }



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A

SYSTEM OF SURGERY,

By BENJAMIN BELL.

VOLUME SIXTH AND LAST.

[Price Six SHILLINGS and Six PENCE in boards.]





A

# T R E A T I S E

ON THE

THEORY AND PRACTICE

OF

# S U R G E R Y.

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## CHAPTER XXXIX.

### OF FRACTURES.

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#### SECTION I.

#### *General Observations on Fractures.*

SOME practitioners denominate every solution of continuity in a bone a Fracture; but the term may, with more propriety, be confined to those divisions in bones which are produced by external violence. Thus, we do not



say that a bone is fractured, the parts of which are separated from each other by the effect of any internal disorder; while we say that it is fractured when this happens from a fall, a blow, or a bruise.

Fractures are of various kinds, and are distinguished by different names. A bone may be fractured either directly across, in an oblique direction, or longitudinally: Hence the terms, Transverse, Oblique, and Longitudinal Fractures. When a bone is split into small pieces, we call it a Splintered Fracture.

When the teguments remain sound, a fracture of a bone is denominated Simple; and we term it Compound when the fracture communicates with a wound in the skin, and other corresponding soft parts. By some a fracture is said to be Compound when a bone is broke into different parts; and those fractures they term Complicated, which are accompanied with wounds in the corresponding soft parts. This subdivision, however, of fractures, seems to

to be unnecessary: for unless a bone is splintered, no essential difference arises merely from its being broke at one or two parts; whereas the slightest communication between a fracture and a wound in the surrounding soft parts, is apt to change the nature of it so entirely, as to induce danger, and even death, in cases where no alarming symptoms would otherwise have been dreaded.

The existence of fracture is, for the most part, easily discovered by manual examination. A fracture of a single bone, where there is only one in the fractured part of a limb, and the fracture of both bones when there are two, as well as a fracture accompanied with an extensive wound of the contiguous soft parts, are easily detected: But in simple fractures, where only one bone of a limb has suffered, it is often difficult to judge with any degree of precision; and more particularly so where the contiguous parts have become tense and painful before a practitioner is called. In such cases, our opinion must be formed by a



minute attention to different circumstances: The age and habit of body of the patient; the site of the supposed fracture; the situation of the limb when the injury was received; and, lastly, to the attending symptoms.

In old people, bones are fractured more easily than in those who are at an earlier period of life. In infancy, bones will rather yield than break upon the application of a moderate force; whilst in old age they become so brittle, that the largest in the body are frequently broke upon the most trifling falls and bruises.

Different diseases induce this brittle state of the bones, particularly the lues venerea. Of this I have met with several instances. In two cases, the largest and hardest bones were broke solely by the ordinary action of the muscles of the limb. It is also the effect of the sea-scurvy: bones that have been fractured and long united having been frequently separated in advanced stages of the real scurvy, the callus being either dissolved or

or rendered too soft for the purpose of retaining them together.

Besides these general affections of the body, the bones themselves are liable to a disease which renders them soft and flexible. It is usually termed *Mollities Ossium*. In some cases, it goes no further than to produce that state of the bones we have mentioned, in which they are apt to be fractured by slight falls, and other similar accidents: But in others, it has been known to proceed to such a height, that every bone in the body has become crooked and distorted. I have seen a skeleton in which the condyles of the knee-joints were turned up to the pubes, and in which every other bone was crooked in nearly a similar degree.

In judging therefore of the probability of a fracture from the degree of violence applied, these circumstances deserve particular attention: For it is evident, that in old age, and in the diseased states of bones we have mentioned, a degree of force will occasion fracture, which in



other situations would not be equal to this effect.

The site of a supposed fracture is also to be taken into consideration. Bones are more apt to be broke in those places where they are hard and brittle, as in the firmer parts of all the long bones, than towards their extremities, where they are of a more soft and yielding texture; and bones that lie deep under the cover and protection of muscular parts, as in the thighs, are not so frequently fractured as those of the arms and legs that are not so well protected.

Further, the situation of a limb when an injury is inflicted, is an object of inquiry. Thus, a very inconsiderable weight passing over a bone lying on an unequal surface, will readily produce a fracture; while the same bone, equally supported, will bear a heavy load without being injured.

In forming an opinion of the probability of a fracture having taken place, we ought, lastly, to take into consideration the symptoms which usually accompany frac-

fracture. These are, pain, swelling, and tension in the contiguous parts ; a more or less crooked and distorted state of the limb ; a crackling or grating noise on the parts being handled ; and loss of power to a certain extent in the injured limb.

It is true, that the mere fracture of a bone is not necessarily attended with much pain ; for the bones, not being so plentifully supplied with nerves as the softer parts of the body, they are therefore of a less irritable nature. But pain arises from two circumstances with which fractures are usually attended ; the contiguous soft parts being bruised and otherwise hurt, in the first place by the force producing the injury, and afterwards by the displaced ends of the bones. For the most part the pain indeed is not very severe : but in some cases it becomes so violent as to be productive of the most alarming symptoms ; spasmodic affections of the muscles in the injured limb ; high degrees of inflammation ; fever, accompanied with *subfultus tendinum* ; general



convulsions and delirium; and if the cause by which these symptoms were induced be not soon obviated, they very commonly terminate in the death of the patient. In general this is preceded by mortification of the parts contiguous to the fracture; but in some instances, affections of this kind prove fatal from the violence of the fever, and without any tendency to gangrene being perceptible.

When the force by which a fracture is produced has been extensively applied over a limb, we may readily suppose that the severest symptoms may be induced by this cause alone; but in general it will be found, when the pain, tension, and convulsive twitchings of the muscles are violent, that they chiefly originate from the adjoining membranes, muscles, or other soft parts being lacerated, punctured, or compressed by the ends of the fractured bones: And although this may happen in fractures of every description, yet it will necessarily be a more frequent occurrence in those that are so oblique as to admit of the bones passing easily  
over

over each other, than in transverse fractures, where the parts, on being replaced, more readily remain in their natural situation.

The other diagnostic symptoms of fracture we enumerated, a grating noise on the parts being handled, and distortion and loss of power to a certain extent in the injured limb, will be found on a minute examination to accompany almost every accident of this kind. They will indeed be much more evident in some fractures than in others : but in all they may be discovered where the parts are not much swelled, excepting in the case of a longitudinal fracture. A bone may indeed be split in this direction without any of these symptoms taking place : for unless the divided parts be completely separated from each other, neither distortion nor crackling will be perceived on handling them ; nor will the bone be rendered incapable of sustaining those parts of the body which usually rest on it. In such cases, we judge of the probability of a fracture  
having

having happened, from the violence of the injury, the severity of the symptoms, and other circumstances already enumerated.

Besides these leading symptoms of fractures which take place immediately on the injury being inflicted, there are others which occasionally occur from the first, and some which we are to consider as consequences rather than symptoms. Of the first, the most remarkable are, that great degree of ecchymosis which in some cases appears instantaneously, from the ends of the fractured bones having penetrated a contiguous artery or vein; and the wound or laceration of the teguments in compound fractures.

The most important consequences of fractures are, stiffness and immobility of the injured limb; distortion of the parts chiefly affected, either from a fulness or thickness remaining in the contiguous muscles or ligaments; an exuberancy of callus; a contracted state of the contiguous joints; or a marasmus or wasting  
of



of the limb itself. All these we shall consider more particularly when we come to speak of the treatment of fractures.

In judging of a fracture, and the probable event of it, various circumstances are to be considered: particularly the age and habit of body of the patient; the situation of the bone, and the part of it that is injured; the nature of the attending symptoms; the circumstances with which the fracture may be complicated; and the kind of fracture.

With respect to the first of these, namely, the age and habit of body of the patient, we all know that they are points of much importance in the cure of every injury to which the human body is liable; and in none more than in fractures. Thus in youth, particularly in infancy, fractures in general cure much more quickly than in old age; and in sound healthy constitutions, much more readily than in such as are diseased. We have observed above, that the bones are  
apt

apt to become very brittle in lues venerea ; and it may here be remarked, that the existence of that disease, or of scurvy, is found to be particularly adverse to the reunion of fractured parts. I have met with some exceptions to this, where fractures have been easily cured even in advanced stages of the lues venerea : but there is much reason to think that this is not a common occurrence ; and that where this disease has attacked the bones, no callus will form till the virus be eradicated.

In speaking of the effect of age on the cure of fractures, although I admit that the divided parts of bones unite more speedily in infancy than in old age, yet I think it right to remark, that it does not appear to happen with more certainty. By many we are told, that in advanced periods of life the union of fractured bones is often not to be accomplished. I have never, however, seen an instance of this, although I have

had the management of many fractures even in extreme old age.

The situation and part of the bone that is injured are both circumstances requiring attention. Thus we know, that fractures of the small bones of the arms and legs, of the feet and hands, and of the ribs, in general heal quickly and easily; while fractures of the larger bones, particularly of the femur and humerus, are managed with much more difficulty. In the last, indeed, one principal cause of the cure proving for the most part very tedious, is the difficulty of retaining the ends of the fractured bones together. But whatever the cause may be, it will necessarily have the same effect on our prognosis.

When any of the large bones are fractured near to their extremities, we find the danger to be much greater, and the prospect of a complete cure much less, than when they are broke near to their middle: For here the shortness of one end of the bone makes the retention of  
it



it difficult ; and the symptoms which ensue from a fracture in this situation are apt to be particularly severe, not only from the contiguity of the capsular ligaments of the joints, which may thus be injured, but from the numerous tendons inserted into these parts of the bones ; which may not only be lacerated and bruised, but even tore from their insertions. Besides, the ends of bones are not only soft, but even spongy or cellular in their texture : Hence fractures near the extremities of bones are more tedious in the cure, and give rise to more troublesome symptoms, than in the harder parts of them : for the fractured parts do not here unite with such equality ; they more frequently exfoliate, and matter is more apt to form in them.

It is also proper to remark, that fractures near the extremities of bones are frequently productive of stiff immovable joints, unweildy limbs, pains and swellings ; which, in various instances,

even under the best treatment, continue obstinate for a great length of time, and in some cases during the life of the patient.

We are in general led to suppose, that these consequences are solely owing to mismanagement, either on the part of the surgeon or of the patient. That in some cases they are so, no person will deny. The ends of a fractured bone may be improperly placed from the first by the practitioner, or they may be afterwards misplaced by the patient; and in either case we may readily imagine, that all the symptoms we have mentioned will take place. But in justice to the profession, we must observe, that they are more frequently to be attributed to the situation and nature of the fracture than to any other cause. Nor is it surprising that it should be so. When we consider the various circumstances with which a fracture is often accompanied; the degree of violence required to break a large bone; the severe contusion of the contiguous soft parts which this must produce;

duce; and the laceration of nerves, muscles, and ligaments, which must occur from the spiculæ of the fractured portions of bone; we should rather be apt to suppose that they would be more frequently productive of troublesome consequences than we actually find to be the case.

In forming a judgment of the nature and probable event of fractures, the symptoms which take place merit particular attention. If the symptoms are moderate, when compared with the apparent degree of violence the parts have suffered, our prognosis should be proportionally favourable: But whenever the attending symptoms are severe, particularly if the pain be uncommonly violent, and the swelling and tension considerable, however trifling the force may have been by which the fracture was produced, the case will probably be difficult to manage and uncertain in the event. In such circumstances, therefore, even in what is usually termed a Simple  
Fracture,



Fracture, our prognosis should be guarded.

The circumstances with which a fracture may be complicated are likewise of importance ; and unless they are duly weighed, no accurate judgment can be formed of the event. The contiguous muscles and other soft parts may be severely contused ; some of the ligaments and tendons of the injured part may be ruptured or even tore from their insertions ; and the fracture may be combined with a dislocation of one or both of the contiguous joints. These accidents aggravate the danger in every case of fracture.

The last consideration on this subject respects the kind of fracture. The greatest difference is observed between the event of a simple and of a compound fracture. A great proportion of cases of simple fracture are of a mild nature from the first ; and with very ordinary attention complete cures are obtained : But in compound fractures, the smallest external wound communicating with the

injury in the bone will often be productive of the greatest danger. I do not mean to say that this happens in every case; on the contrary, we know that even the worst cases of compound fractures will, with proper attention, often terminate in the most favourable manner: But every practitioner much versant in this branch of business will allow that this is not to be depended on; and that even under the best management such cases are so apt to go wrong, as to warrant the opinion we have given of them, and to render it proper in almost every instance to give a guarded prognosis.

Authors lay down various indications for the cure of fractures; and these we are desired to have strictly in view: Namely, extension; counter extension; coaptation, or replacement of the fractured parts; deligation, in so far as is necessary for retaining them; position of the injured part; and prevention or removal of bad symptoms.

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The subject, however, may be simplified, and the indications with propriety restricted to three: To replace the parts of the bone that have been moved from their natural situation; to retain them in this situation as long as may be necessary; and to obviate such symptoms as may supervene during the cure.

In some few favourable cases, where the bones are fractured directly across, they are either not moved out of their natural situation, or the alteration is so inconsiderable that they are easily replaced. But when the bones of a limb are broke in an oblique direction, they are apt to pass one another so as to produce much deformity and pain. The contiguous muscles are thus severely injured, and excited to violent action: Hence in all such affections the malady is increased by every natural exertion either of the whole body or of the part more immediately injured; and nothing will remove it but an artificial replacement of the distorted bones.



To accomplish this, various methods have been proposed. In former times it was effected by much violence and force : by what was termed Extension and Counter Extension ; but we now know that our purpose may be accomplished in an easier manner, with less pain to the patient, and less trouble to the operator.

As long as it was imagined that much force ought to be employed, the limb was extended by one or more assistants pulling at each end of it ; and when this was not sufficient to draw the bones into their natural situation, different machines were used for this purpose. The necessary force was in general applied while the limb was on the stretch ; a circumstance which added much to the difficulty of reducing the fractured parts of the bone : for in this manner all the contiguous muscles were put into action ; nor could the bones be replaced till this was overcome by the application of a superior force. The mischief which this

would

would often produce, it is easier to imagine than to express.

When it is considered, that in the reduction of a fractured bone the chief resistance we meet with is the action of the neighbouring muscles, the propriety of putting the limb into such a posture during the operation as favours the relaxation of the different muscles connected with it, is so obvious, that we now reflect with surprise, that it was left to the practitioners of the present age to propose this measure. For, whatever may have been the ideas of a few individuals, it is certain, that till very lately it was the general practice to keep every limb in an extended position while any attempt was making to replace the fractured bones, and that it is chiefly to Mr Pott we owe the introduction of the contrary practice.

In the treatment of a fracture, if we take care to relax all the muscles of the limb, it is surprising with what ease the ends of the bones may in general be re-

placed. When a limb is laid completely in this relaxed posture, the surgeon will in most cases be able to replace them without any assistance whatever: But when he does not succeed, a slight degree of extension may be employed, by the upper part of the limb being kept firm by one assistant with his hands placed between the fracture and the contiguous joint, while the under part of it is gently extended by another; care being still taken, however, to keep the muscles as much relaxed as possible.

As it is of the utmost importance in replacing the fractured parts of the bone to do it with exactness, the nicest attention should be paid to this part of the operation. Every inequality depending upon any portion of bone being displaced should be removed, so as to render the injured part as similar as possible to the corresponding sound limb; which, for the purpose of a more attentive examination, should be placed as near to it



as the conveniency of the operator will permit.

The necessity of attention to this part of the treatment will appear from this, that when the fractured bones are not properly reduced at first, the limb must either remain always distorted, or it must be put right during a future stage of the treatment; when it will necessarily be done with more pain to the patient and more trouble and perplexity to the surgeon.

The bones being put right, our next object is to retain them in this situation as long as may be necessary. This we do by proper compresses and bandages, and by placing the limb in such a state of relaxation as will admit of its resting with ease, and without being disturbed, till the cure be completed. When we come to treat of fractures of particular parts, the posture in which they should be placed, and the bandages that appear to be best adapted to them, will be described. At present we may observe,

that no bandage should be applied with more tightness than is necessary for retaining the bones in their situation ; and that this may, for the most part, be easily effected, if the limb be kept in such a posture as to relax the various muscles connected with it.

The time required for rendering the union of fractured bones sufficiently firm, depends upon various circumstances : Upon the size of the bone, and the weight which it has to support ; on the age and habit of body of the patient ; and on the cure having proceeded with more or less interruption, from the limb having been kept more or less steadily in its situation, as well as from the attending symptoms of swelling, pain, and inflammation, having been mild or severe. In a healthy middle-aged patient, when no untoward symptoms have occurred, and when the injured parts have been retained exactly in their situation, a cure of a fractured femur, or of the bones of the leg, will be accomplished

ed

ed in two months ; of the humerus and bones of the fore-arm, in six weeks ; of the clavicles, ribs, and bones of the fingers and toes, hands and feet, in three weeks. In infancy and childhood, fractures in all these parts heal much more quickly ; while in old age this uniting process goes on more slowly, and therefore requires more time to accomplish.

In simple fractures, to which these general observations more particularly apply, the pain, tension, and other symptoms, are in general moderate, and usually subside entirely in the course of a few days, if the bones be properly retained in their situation : but in some cases, instead of diminishing, they become daily more violent, so as to be productive of much distress to the patient, as well as trouble and embarrassment to the practitioner.

When the muscles and other soft parts of the limb have not been much contused, there is perhaps no necessity for any  
appli-



application, with a view to the prevention either of pain or tension: but for the most part it is proper to guard against the violence of these symptoms, by the early use of some astringent applications, such as, a solution of saccharum saturni, of crude sal ammoniac, or spiritus Mindereri; and when these fail, by a free application of leeches over all the pained parts. Indeed, the practice of taking away blood by leeches proves in every case of this kind so beneficial, that I always advise it whenever the tension is in any degree considerable, or whenever the pain continues severe after the bones have been replaced. In every case of fracture, inflammation is the symptom which, in the first place, we have most reason to dread; and as nothing tends with such certainty to prevent or remove it as local blood-letting, it should never be omitted when the surrounding soft parts are much injured: Nor should the practice be delayed after it appears to be in

in any degree necessary; for it proves always most effectual when employed soon after an injury has been inflicted.

Besides the immediate advantage of relieving the pain in the injured part, nothing prevents with such certainty the troublesome consequences of contusion in cases of fracture as the early application of leeches. Of these consequences the most remarkable are, deep-seated abscesses, which in some instances form within the cavity of the bone itself, and in others in the surrounding cellular substance; long continued pains, resembling rheumatic affections, stretching over the injured limb; a thickened enlarged state of the periosteum and other soft parts; a stiff contracted state of the contiguous tendons; an exuberancy of callus; and an unwieldy state of the whole member.

It is well known to all who are versant in this branch of business, that all of these consequences are apt to succeed to fractures accompanied with much contusion;

tusion : And nothing proves more perplexing to surgeons, or more distressful to patients : for when they are not soon removed, they are very apt to prove permanent ; and for the most part they are attributed to some mismanagement in the reduction of the fracture.

In many instances they no doubt arise from the extremities of the fractured bone not being properly replaced, or not retained with exactness afterwards : but they more frequently proceed from the inflammation which follows from contusion. It is therefore evident, that early leeching can alone be useful. When swelling and pain in a fractured limb have continued long, the most effectual relief is obtained from frictions with emollient oils, and from warm bathing, particularly from a proper use of the waters of Buxton, Bath, and Barreges.

We are sometimes disappointed in obtaining complete cures of fractures, by the limbs remaining unseemly from an over-growth of callus. It is not a common



mon occurrence ; but every practitioner must have met with it. As far as I am able to judge, in fractures attended with much inflammation, where this inconveniency is most apt to occur, local blood-letting proves more useful than any other remedy in preventing it. In some cases, however, the tendency to form callus is so great that it can scarcely be checked. The application of ardent spirits, and of other astringents, is here supposed to prove useful ; and I have in some instances derived advantage from a continued gentle pressure, which is best applied by means of a thin plate of lead adapted to the form of the part, and retained by a proper bandage : But as neither this nor any other remedy will prove successful in every case, and as patients are apt to regret nothing so much as a disappointment in obtaining a complete cure of a fracture, our safest course, as soon as the callus begins to be too luxuriant, is to acquaint the patient with the probable event ; and he must be ve-

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ry unreasonable indeed, if he afterwards repines at what the utmost care and attention could not prevent.

Among the consequences which sometimes result from fractures, there is one which we must consider more particularly; namely, a difficulty of obtaining an union between the ends of the fractured bones, by which they remain loose and detached long after they should have been firmly knitted together.

This may proceed from various causes: From some constitutional disease, such as rickets, scurvy, or lues venerea; from the ends of the fractured bones not being kept steadily in contact till their complete reunion be accomplished; from a portion of a muscle, tendon, or ligament, falling in between the ends of the fractured parts, so as to prevent them from being placed in contact; and in some cases it proceeds from a bone being broke in different parts, and the intermediate detached pieces being so small

as to prevent them from adhering even when kept in close contact.

It has been observed, too, that occurrences of this kind happen more frequently during pregnancy than in other situations. This has not indeed fallen within my observation; but it appears to be the general opinion of practitioners, and different instances of it are recorded by authors.

When this want of union proceeds from any general disease of the system, those remedies must be employed which are known to prove most effectual in removing it: for no attention on the part of the surgeon will produce any advantage till this be accomplished; and as much mischief is often prevented by an early application of remedies, they should always be advised as soon as the cause is observed to exist. It would even be a proper precaution, where it is known that a patient at the time of receiving a fracture labours under any constitutional disorder, to advise such a course



course immediately ; by which means cures might be accelerated, which otherwise would be unnecessarily protracted.

When the union has been prevented by the fractured bones not having been kept steadily in a proper situation, the bones should be replaced and retained in their situation with as much exactness as possible ; and when the injury is still recent, a perfect union may by this means be still accomplished.

But where a fracture has continued long without any union being formed between the ends of the bones, the osseous matter by which they should have been knit together becomes hard, smooth, and totally unfit for the purpose, in so much that no advantage could be derived from their being replaced. Of this I have met with different instances, where the ends of the fractured bones were become perfectly smooth, and moved on each other with the same ease and freedom as the bones of any of the joints :

joints : and various cases of it are to be met with in authors.

In this situation, when no great inconveniency is experienced, the patient should be advised to submit to it, particularly in fractures of the small bones, such as those of the fingers and toes, the bones of the metacarpus and metatarsus, the clavicles, and ribs : but in the large bones of the extremities, where much firmness is required, and where any injury of this kind must be productive of almost a total loss of the use of the limb, as we may be able by an operation to restore it, we ought perhaps in every instance to propose it. By making an incision through the surrounding soft parts, so as to lay the ends of the bones bare, and removing a small portion of each of them either with a common saw or with the head of a trepan, we reduce them to the state of a recent fracture ; when, by taking care to retain them in a proper situation, we may in due time expect a complete cure.

The operation is no doubt painful and tedious: for the incision should be extensive in order to admit of a free application of the instruments; and for the most part it must be conducted with much caution, in order to avoid the large blood-vessels of the limb: But it may be done with perfect safety by any person accustomed to the operative part of surgery\*.

Nor should we be deterred from proposing this method of cure from any apprehension about the extent of the vacancy that may be produced by the removal of the ends of the bones: for if the limb be kept steadily in its situation, and if the constitution be healthy, nature will not probably fail in supplying the deficiency. Thus we have many instances upon record, even of entire bones being regenerated; and, in a lesser degree, the powers of nature on this point

\* Vide White's Cases in Surgery, where two instances of this are recorded.



point must have fallen within the observation of every practitioner.

A bone is often broke in different parts, and a cure notwithstanding obtained : but when the detached parts are so small that the circulation will not probably be kept up in them, as they will thus be rendered incapable of furnishing the secretion by which their reunion should be accomplished, it would be better to remove them at once than to impede the cure by any attempt to save them. Accordingly, in all compound fractures, where the injured bone is already laid bare, it is the practice of our best surgeons to remove all such detached portions as might not probably unite with the remaining parts of the bone. But in simple fractures, where the skin remains entire, as we cannot judge with such certainty of the nature and extent of the injury, nor of the probability of our being able to preserve all the loose portions of bone, we endeavour in the first place to accomplish a cure in the easiest

manner, by placing the parts in such a position as will most readily admit of their union being effected: but when this does not succeed, when the ends of the bone remain loose long after they should have been united, and one or more detached pieces are discovered, these are to be considered as extraneous bodies, and ought to be removed with the fingers or forceps, at an opening made through the soft parts for this purpose.

Experience enables me to recommend this method of treatment with confidence. I have met with different cases, where a cure being considered as impracticable from no union having formed between the ends of fractured bones, was at last accomplished in the course of a very short time by the removal of some loose fragments.

But the most perplexing cause preventing the reunion of fractured bones, is a portion of a muscle, ligament, or some other soft part passing between them. We judge that this is the case when the  
pain

pain and tension of the injured part have been more severe than usual from the first ; when particular movements of the limb occasion severe pain and twitchings of the muscles that serve to move it ; and when the ends of the fractured bone do not unite at the usual time.

As soon as there is any reason to think that a cure is prevented by the cause we have just mentioned, we should endeavour to remove the portion of interposing membrane or muscle, by putting the limb into all the variety of postures by which it will be most readily effected. But when this does not succeed, as will often be the case, and when the bones still remain loose long after the usual period, we ought, without farther hesitation, to make an incision upon the fractured part. When the injury has not been of long duration, a cure will be accomplished merely by bringing the ends of the fractured bone into contact : But when this measure has been too long delayed, and when the osseous matter



poured out by the fractured extremities of the bone has become hard, a small portion of it should be removed either by a saw or with some sharp instrument, so as to convert the injury once more into the state of a recent fracture; otherwise no advantage will be gained by the operation.

Besides these causes I have mentioned, which tend to impede the cure of a fractured bone, it may not be improper to remark, that the effusion of much blood around the injured bone is very apt to be productive of the same effect. It is seldom, in cases of simple fracture, that any of the larger blood-vessels are injured; and blood effused from small arteries is for the most part soon absorbed, and no bad effects result from it. But instances sometimes occur even in simple fractures, of a large blood-vessel being cut by the sharp spiculæ of bone. When the quantity of blood thrown out is considerable, the tumefaction of the limb becomes so great, that it is necessary to  
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lay it open in order to secure the divided vessel with a ligature: but where the swelling does not arrive at any alarming height, we rather trust to the natural contractility of the artery for stopping the hemorrhagy, and to the powers of the absorbents for removing the blood already effused. In some such cases, where blood has remained long in contact with the extremities of the fractured bone, the power of forming callus appears to have been destroyed by it; the periosteum separates for a considerable space from each end of the bone; and on laying the parts open, no union is found to have taken place; the spiculæ produced by the fracture remain equally sharp as at first; and, for the most part, a thin fetid sanies is discharged from the fore.

In this situation, a cure will not be obtained till those parts of the bone which have been denuded of the periosteum have exfoliated. As exfoliation is in general a tedious process, we would rather advise the removal of the denuded bone

by means of a saw. A more expeditious and more certain cure will thus be obtained.

Having premised these general observations, we proceed to the consideration of fractures in particular parts.

## SECTION II.

### *Of Fractures of the Nose.*

THE arch formed by the bones of the nose prevents them from being so frequently fractured as they otherwise would be. They are necessarily, however, liable to every variety of fracture when exposed to any great degree of violence.

Besides the usual symptoms of fractures, injuries of this kind in the bones of the nose are apt to impede respiration; they affect



affect the speech and the sense of smelling; polypi and tedious ulcers sometimes ensue from them; and they are rendered more particularly hazardous from their contiguity to the brain. These fractures therefore require the most exact attention.

When we have ascertained the nature and extent of the fracture, our next object is to replace the bones as nearly as possible in their natural situation. When any part of them have been elevated or raised above the level of the rest, it must be pressed into its situation with the fingers; while such parts of them as may have been forced into either of the nostrils must be elevated with the end of a narrow spatula, or any other instrument of a similar form. Any portion of bone that is quite loose, and nearly separated from the rest, should be removed immediately, whether it be raised up or forced into the nostril; but whatever adheres to the remaining portion of bone with much firmness, should be replaced in the manner we have mentioned.

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If the bones be properly replaced, they will for the most part remain in their situation without any assistance. If there is a wound, it must be dressed in the usual way; and whether the teguments be injured or not, we should endeavour to prevent inflammation by the use of saturnine applications, and by local blood-letting when the violence of symptoms renders it necessary.

But when the parts that have been replaced do not remain firm in their situation, we are under the necessity of endeavouring to retain them. If they fall into the nostrils, the best method of effecting this is to introduce such tubes into them as are represented in Plate XLIII. fig. 2. If the tubes are covered with soft lint, spread with any emollient ointment, they may be kept in the nostrils as long as may be necessary. While, on the contrary, if any part of the bone is raised above the rest, it must be kept down by a proper application of a double-headed roller. If the teguments

ments are injured, the sore must be first dressed; care being taken in doing it to prevent deformity as much as possible: a compress of soft old linen must be next applied; and over the whole an equal pressure must be made by the bandage we have just mentioned.

In this manner a cure may be obtained of almost every injury of this kind, unless the bones have been so much shattered, that their reunion cannot be accomplished. In which event, all that art can do is to extract the detached pieces, and to co-operate as much as possible with nature in healing the remaining sore.

## SECTION



## SECTION III.

*Of Fractures of the Bones of the Face.*

WHEN treating of fractures of the skull, those of the upper part of the face were considered. At present we have only a few observations to offer on fractures of the superior maxillary and cheek-bones, being those which form the most prominent parts of the sides of the face.

The vicinity of those bones to the eyes and to the nose, and the situation of the antrum maxillare, make fractures of these important. When the fractures stretch toward the eyes, they are apt to induce much inflammation, which often proves dangerous; and when they penetrate the antrum, they not only prove extremely tedious, but very commonly occasion a good deal of deformity: for

when the anterior part of that cavity is laid open, and any portion of the bone removed, the face becomes flat, and the teguments puckered, notwithstanding all that can be done to prevent it.

In every injury therefore of this kind, we ought to be careful in replacing any portion of bone that may be fractured, so as to favour its reunion with the rest; and any wound that accompanies the fracture should be dressed with much attention, that deformity, as far as it is possible, may be prevented.

After the bones are replaced, which may be done either with the fingers where there is no wound, or with forceps or a narrow spatula when the parts are laid open, a piece of adhesive plaster will answer better than any bandage for retaining the necessary dressings. Blood-letting and an antiphlogistic regimen must be advised to obviate inflammation of the eye or contiguous parts, which otherwise might ensue. The remaining part of the cure, namely, the reunion of the fractured

fractured parts of the bone, must be left entirely to nature.

When the fracture penetrates the antrum, the matter which collects in that cavity cannot be properly evacuated from any opening that may take place on the prominent part of the cheek. In consequence of this, I have known sinuous ulcers formed that have continued open for a great number of years. They can only be healed by giving a free vent to the matter, by an opening made in the most depending part of the cavity, in the manner we have advised in Chap. XXX. Section V.

#### S E C T I O N IV.

##### *Of Fractures of the inferior Maxillary Bones.*

**A**LTHOUGH the bones of the under jaws are very strong and compact, yet fractures of one, or even of both, are



not unfrequent. This seems to arise from blows or other injuries to which these bones are exposed, being most apt to fall upon their anterior flat surfaces, where they are less capable of resisting violence than in any other part.

We judge of the existence of a fracture in the jaw by the deformity which it occasions; by the crackling of the bone when handled; by inability to move the jaw; by the violence of the injury, and the degree of pain with which it is accompanied.—When both jaws are broke, the injury becomes obvious; as in this case a considerable separation takes place at the fractured part: but even where one bone only is fractured, it may be always discovered with a little attention.

The site of the fracture being exactly ascertained, our next object is to replace the bones with as much care as possible: which is done by placing the patient in a proper light, having his head firmly secured, and the fingers of one hand pressing

pressing upon the inside of the jaw, while the other hand is employed externally in guarding against any perceptible inequality of the bone. One of the teeth is commonly seated in the course of the fracture; and in this situation acting as an extraneous body, and thus tending to retard the cure, it should be a general rule to extract it immediately: But when any of the teeth not seated in the course of the fracture, are forced out of their sockets, it may be right almost in every instance to replace them, and to endeavour to fix them, by tying them to the contiguous firm teeth.

This being done, our next object is to retain the fractured bones in a proper situation till they are firmly reunited. For this purpose a variety of splints have been invented, both of paste-board and other materials; but as a compress and bandage either of soft old linen or cotton answers the purpose with equal certainty, and as they sit with much more ease to the patient, they should always be

be preferred. The parts being kept firm by an assistant, a thick compress should be laid over the chin, and be made to extend from ear to ear along each jaw; and over the whole a four-headed roller should be applied in the manner we shall mention when treating of bandages. In using this bandage, it should not be made so tight as to give much uneasiness, or to endanger the circulation, at the same time that it should be applied in such a manner as to keep the fractured parts of the bone in close contact.

During the cure the patient should be kept perfectly quiet. He should be fed entirely on spoon-meat. He should be enjoined to avoid speaking and laughter, or the use of his jaws in any manner of way. To prevent the displacement of the bones, which is apt to happen from frequent inspection, the bandage should be applied with such attention, that there may be no occasion to move it oftener than is altogether necessary. In compound fractures of this part, there is in-



deed a necessity for moving the bandage daily, as the fore cannot otherwise be regularly dressed. It ought always to be done, however, with the utmost attention, an assistant taking care to support the parts with his hands during the removal of the old, and the application of the new, dressings.

The management of a fracture of one or both jaw-bones is exactly similar; only where both bones are broke, there is still more attention required than when one only is fractured. In a fracture of one of the bones, the patient may be allowed to eat soft meats, and to speak with freedom, in the space of three weeks: But where both bones have suffered, this should not be permitted till the conclusion of the fifth week.

## SECTION

## SECTION V.

*Of Fractures of the Clavicles and Ribs.*

THE clavicles and ribs are more liable to fractures than any other bones. This proceeds not only from the slender structure of these bones, but from the transverse position in which they are placed, with their flat-broad-sides exposed to every injury that may be applied to them.

A fracture of the clavicle is in general easily distinguished. A grating noise is produced by the ends of the bone rubbing against each other on the arm of the same side being smartly moved. The ends of the fractured part readily yield to pressure; and, for the most part, the end of the bone connected with the humerus is pulled to some distance from

the other by the weight of the arm. The motion of the humerus is impeded, and some degree of swelling, accompanied with more or less pain, takes place over the injured part.

In examining a fractured clavicle, we almost always find the end connected with the sternum higher than the other, which has suggested an idea that has prevailed very universally in the method of cure. It is supposed that the height of this part of the bone proceeds from its having started or risen out of its natural situation: In the reduction, therefore, of the fracture, a good deal of pains is commonly taken to press it down, and very tight bandages are employed to prevent it from rising during the cure. I believe, however, it will be found, that this part of the bone rises very little out of its natural situation, and that the appearance of its doing so proceeds almost entirely from the other end of the bone being dragged downwards by the cause we have mentioned, namely, by the weight of the arm. At any rate, no  
advan-



advantage is obtained from this practice: for a force that would be necessary for pressing down the end of the bone cannot be applied without the effect of cutting the teguments, by pressing them against that part of it which is supposed to be elevated; while our purpose is fully answered by raising the arm, and supporting it at a proper height. The depressed portion of the fractured clavicle is thus raised and brought into contact with the superior part. In some cases, indeed, of very oblique fractures, it may be impossible to bring the ends of the bone in every point exactly opposite to each other: but this may be always so far accomplished as to enable us to avoid deformity, and to render the bone sufficiently strong.

When the ends of the bone are brought into contact, our object is to retain them in this situation till they are united; and, as we have observed above, this can only be done by affording a proper support to the arm.

The arm is usually supported by a

slings hung round the neck, adapted to the length of the arm, and every where equally applied to it. But the leather case represented in Plate LXXXI. fig. 1. answers this purpose with more ease and neatness. By means of it the fore-arm and elbow-joint are more equally and more effectually supported : and this last is a point of no small importance ; for if the elbow be allowed to drop, the humerus and scapula will both fall down, by which the ends of the fractured clavicle will again be separated.

We are commonly directed in the treatment of fractures of this bone to have the shoulders drawn back and the head raised ; and instruments are described for effecting these purposes. No general rule, however, of this kind can be laid down : for in some cases we find that the fractured parts of the bone are kept most exactly together when the head is bent down upon the breast ; while in others, it is better accomplished while the head and shoulders are raised.

In other points, fractures of the clavicle

vicle must be treated like similar injuries in other parts of the body. When there is much pain and swelling, bleeding with leeches becomes proper; but in general, injuries of this kind are so slight, that the common saturnine applications prove sufficient for removing any inflammation or swelling that occur. When the fracture is accompanied with a wound, any splinters of bone that may be discovered must be removed, and the wound itself dressed in the usual way. It is proper, however, to remark, from the vicinity of the subclavian artery, that the removal of any portion of the clavicle must be attended with danger, and ought therefore to be managed with caution.

When the ends of the fractured part are supported with exactness, they will in general be firmly united in the space of a fortnight; but the corresponding arm should never be used with freedom till the end of the third or fourth week.

We discover fractures of the ribs by the seat of the pain, and by pressure with



the fingers. For the most part, the symptoms which take place are moderate ; the pain induced by the fracture is inconsiderable, no fever occurs, and the patient soon gets well: But in some instances the pain is severe from the first ; the breathing becomes difficult, attended with cough, and perhaps a spitting of blood ; and the pulse is quick, full, and sometimes oppressed.

It will readily be understood, that a fractured rib cannot of itself induce any of these symptoms: But in some instances the ribs are not only fractured, but pushed inwards upon the pleura and lungs ; when, from the compression and laceration of these parts, we may easily perceive how pain, oppression in breathing, and fever, should be induced ; and at the same time be able to account for the emphysematous swellings described in Chapter XXII. Section V.

In every case of fracture of the ribs, it is a safe and proper practice to discharge a quantity of blood proportioned

to the strength of the patient. If any inequality is discovered, by one end of the rib having risen above the other, we ought to endeavour by moderate equal pressure to replace it; and to prevent it from rising, a broad leather belt should be applied, and drawn as tight as the patient can easily bear it. When a belt of this kind is properly lined, either with quilted cotton or flannel, it fits with ease even when tolerably tight; and it ought to be continued for several weeks after the accident.

Even where the symptoms have at first been severe, they will commonly subside upon the patient being freely blooded and kept quiet and on a low regimen: But where the oppressed breathing is kept up by air escaping from a puncture in the surface of the lungs, or by blood discharged from a ruptured intercostal artery into the cavity of the chest, or when the pain is prevented from subsiding by the fractured rib being forced in upon the pleura; it becomes necessary

fary to make an opening with a scalpel. Where a portion of rib is merely forced inwards, this should be done directly upon the injured part ; and on the rib being laid bare, we ought to elevate that part of it that is depressed, either with the fingers, forceps, or a spatula. When the symptoms proceed from air or blood collected in the cavity of the chest, an opening should be made to discharge them, in the manner pointed out in Chapter XXII. Sections III. and V.

Fractures of the ribs should in every instance be treated with attention ; but particularly where there is any tendency to phthisis pulmonalis, when the irritation produced by a fractured rib is very apt to do mischief.

## SECTION



## SECTION VI.

*Of Fractures of the Sternum.*

THE support which the sternum receives from the ribs, and the degree of elasticity which it possesses, render it less liable than it otherwise would be to injury from external violence. It necessarily suffers, however, from the application of any great degree of force. In some cases, it is fractured without being displaced: in others, it is not only broke, but at the same time beat in upon the pleura.

A simple fracture of the sternum is to be considered in the same light with similar injuries done to the ribs, and ought to be treated in the same manner. But more danger is apt to ensue from any

portion of this bone being forced into the chest from the vicinity of the large blood-vessels of the breast, while the symptoms with which it is accompanied are nearly the same; namely, pain in the injured part, cough, oppressed breathing, a quick and sometimes an oppressed pulse.

In slight affections of this kind, we are told, that the depressed portion of bone may be raised by desiring the patient to make deep inspirations; by placing a barrel or a drum under his back, and keeping him lying for some time in this posture; and by the application of adhesive plaster over the corresponding teguments; when, by elevating the soft parts, the bone beneath, it is said, may frequently be raised along with them.

It is not to be supposed, however, that any advantage is to be derived from any of these methods; on the contrary, it is more likely that they may do harm: nor would they have been mentioned here, had it not been with a view to caution the younger part of the profession,  
who,

who, finding these modes of practice recommended by all the older writers, might have been induced to adopt them without weighing their consequences. As the skin is no where very intimately connected with the bone beneath, it is not probable that any portion of depressed bone will ever be raised by the external application of adhesive plasters; and we may do harm by trusting to a mode of treatment that is to prove ineffectual. But the practice of advising deep inspirations, and of laying the patient upon his back over a large barrel or any other convex body, must often do mischief, by pushing the lungs with more force against the depressed portion of bone than they otherwise would be.

When it therefore happens that the pain, cough, oppressed breathing, and other symptoms, do not yield to blood-letting and other parts of an antiphlogistic course, some other method of cure should be attempted. An incision should be made upon the injured part  
of



of a sufficient length to admit of a free examination of the bone; when the depressed piece may be raised either with a common scalpel or a levator, if there be an opening that will admit an instrument; or when this is not practicable, an opening may be made for this purpose with the trepan, in the manner we have advised in similar injuries done to the skull in Chapter XXVI.

I know that this will be considered by many as hazardous; but when a patient is in danger either from a portion of a depressed rib or of the sternum, and which cannot otherwise be raised, I would never hesitate in advising it. If the operation be performed with caution, the bone may be raised with safety; and this being done, the sore must be treated in the usual way.

## SECTION

## SECTION VII.

*Of Fractures of the Vertebræ, Os Sacrum,  
Coccyx, and Ossa Innominata.*

**F**RACTURES of the *vertebræ* may be produced by falls and blows; but they are more frequently the consequences of gun-shot wounds than of any other cause.

Injuries of this kind, for the most part, terminate fatally: for although many have survived such fractures for a considerable time, yet they generally linger and die of the consequences. The spinous and oblique processes of the *vertebræ* may indeed be broke without immediate danger; but very commonly the force which effects this gives such a shock to the spinal marrow, as at last terminates

nates in the death of the patient: and a fracture extending through the body of a vertebra will probably, in every instance, prove fatal.

We judge that the vertebræ are fractured, by the feel, by the violence of the injury, and the severity of the pain, and by the parts lying beneath the injured vertebra becoming paralytic when the spinal marrow is affected.

When any of the external parts of the vertebræ are loose, we may in general replace them with our fingers; and confining the patient as much as possible to one posture, we may, by means of the napkin and scapulary bandage, and proper compresses, retain them in their situation till they unite with the rest of the bone.

Where this cannot be done, a patient is in general left to his fate, as it is not supposed that we can with propriety expose any of the vertebræ for the purpose of replacing such parts of them as may be deranged: But wherever we  
find



find that the spinal marrow is compressed, as the immediate effect of an injury done to one or more of the *vertebræ*; and where there is reason to think that the compression is produced by a fracture and depression of a portion of bone, as we know from experience that every such case will terminate fatally if the cause of compression be not removed, it would surely be better to endeavour to raise it than to leave the patient under an absolute certainty of suffering. By laying the injured parts freely open, we may be enabled to raise that portion of bone by which the compression is produced; while it is not possible that the situation of the patient can be rendered more hazardous, even allowing the attempt to prove abortive.

In a case where symptoms of paralysis were induced by a musket-bullet lodged in the substance of one of the *vertebræ*, a complete recovery was obtained by extracting the bullet. A portion of depressed bone might in many instances be

removed with equal ease and safety; and we have reason to suppose that similar effects would often result from it.

In fractures of the os sacrum, the method of treatment must be nearly similar to what we have just advised in fractures of the vertebræ; only, where the injury is seated near to the under part of the bone, as well as in fractures of the coccyx, when any part of it is pressed inward, we may in some cases be able to replace it, by pushing it out with the finger of one hand introduced into the anus, while with the other we co-operate externally.

Where any of the ossa innominata are broke, if the injury be deeply seated, the patient ought to be placed in that posture in which he finds himself easiest, and confined as much as possible to that situation till it is probable the bones may be united. Blood-letting, and an attentive regimen, suited to his strength and the violence of the symptoms, may prevent

vent the inflammation which usually supervenes from becoming considerable.

In more external fractures of these bones, we have it often in our power to replace such parts of them as have been forced out of their natural situation; and by a proper application of bandages, we may also be able to retain them till a cure is completed. I have had different instances of a considerable portion of the ileum being fractured and separated from the rest, and of a cure being easily accomplished, by replacing the parts that were separated, and retaining them with a broad roller passed several times round the pelvis and upper part of the thigh.

With respect to the application of such a bandage, no general directions can be given: It must depend entirely on the judgment of the practitioner; who will apply it in the way which he thinks will make it answer the purpose of fixing the bones in the most effectual manner.



## SECTION VIII.

*Of Fractures of the Scapula.*

THE scapula, from its situation, is not so liable to be fractured as other bones; but every practitioner must have met with instances of this accident. It may be fractured either in the thin plate, of which it is mostly formed; or in one or other of its processes.

As the motion of the arm depends much on a sound and entire state of this bone, and as fractures of any part of it are difficult to cure, they very commonly produce a stiff unwieldy state of the corresponding arm, which usually continues during the life of the patient.

We discover that the scapula is fractured, by the seat of the pain; by the violence

violence of the injury ; by the feeling on pressing the injured parts ; and by stiffness and immobility in the corresponding arm. We are told, that fractures of the scapula are apt to be accompanied with emphysematous swellings. These can only appear when the lungs are wounded by a splinter of the scapula, or of a fractured rib being forced into their substance. When this takes place, air will no doubt escape ; and if it passes into the cellular substance, emphysematous swellings will necessarily occur.

In the treatment of fractures of the scapula, our first object is to replace the bones with as much exactness as possible ; and in doing so, we will be much assisted by relaxing all the muscles connected with the injured part. By raising the head and shoulders we relax the muscles of the back ; and if, at the same time, the humerus be supported, the deltoid muscle will be so much relaxed, that any fractured portion of the scapula may be easily replaced. There is more difficul-

ty, however, in retaining the bones during the cure, than in replacing them: for the detached portion being in general small, it is often impossible to retain it with a bandage. A proper application of a long roller is perhaps the only method by which it can be done; and in using this bandage, we should still take care to have the head and shoulders supported, and the arm suspended, so as to keep all the muscles of the injured part as much relaxed as possible.

As fractures in every part are apt to excite inflammation, we have elsewhere observed, that this symptom should at all times be guarded against. It is no where, however, more necessary to be attentive to this than in fractures of the scapula, where inflammation is more apt to proceed to an alarming height than in any other part. Blood-letting should therefore be freely practised; particularly local blood-letting with leeches, or cupping and scarifying; which we have often had occasion to recommend as perhaps



haps the most effectual means of removing inflammation wherever it may be seated.

## SECTION IX.

*Of Fractures of the Humerus.*

AS the humerus is not thickly covered with soft parts, any fractures to which it is liable are, in general, easily discovered. When they run obliquely, they become often evident to the sight; as in that case the bones are apt to overlay one another: but we have seldom any difficulty in discovering even transverse fractures; which we do by the seat of the pain, the violence of the injury, inability to move the injured arm, and a grating noise being heard on handling the parts affected.

In reducing fractures of this bone, we do not find that much extension is necessary; but in order to accomplish it with ease, the muscles of the arm should be put as much as possible into a state of relaxation; which is done by bending the elbow moderately, at the same time that the limb is raised nearly to a horizontal direction, and not carried so far forward as to put the latissimus dorsi, inserted into the back part of it, on the stretch, or too far back to stretch the pectoral muscle.

The patient being properly placed, and the arm put into this situation, the surgeon will in general be able to replace the bones without any assistance: But when extension is necessary, it may be applied by one assistant grasping the arm between the fracture and the joint of the shoulder, and another above the joint of the elbow.

In this manner the fractured bones are to be exactly replaced; and with a view to secure them in this situation, one splint  
of

of a proper degree of firmness, such as are represented in plate LXXI. figures 5. and 6. should be laid along the whole outside of the arm, and another along the inside of it, each of them covered with soft thin flannel, to prevent them from galling the arm; and while these are secured by one assistant, and the fore-arm supported by another, a flannel roller should be applied over the whole, of such tightness as to support the ends of the fractured bone without interrupting the circulation of the limb.

The fore-arm should be supported in a sling, such as is represented in Plate LXX. fig. 1. and the patient may be either put to bed or allowed to sit, as is most agreeable to himself. It may not, however, be improper to remark, that it answers better to have the arm in a hanging position than laid horizontally upon a pillow; particularly in oblique fractures of this bone, where the weight of the limb has a considerable effect in preventing the ends of the bone from overlapping



lapping each other. Even in bed, therefore, where there is any danger of this taking place, the patient should be placed in such a manner, that his arm may hang instead of being laid in the usual posture. In transverse fractures, this precaution is not altogether so necessary, as the ends of the bone, if they be once properly replaced, serve effectually to support each other. But even in these, it is the best practice to support the forearm in such a manner that it may have some effect in pulling the under part of the humerus gently downwards.

If no urgent symptom occurs, such as much pain and swelling of the arm, the bandage should not be moved for several days: But about the seventh or eighth day, it is proper, in every fracture, to remove all the coverings, in order to see whether the bone be perfectly in its place or not: for at this period any accidental displacement may be easily put right, and a cautious inspection may be made with the utmost safety.

We

We have advised a roller to be employed for fractures of this bone; and perhaps it is the only instance in fractures of the large bones of the extremities in which it should be preferred to the many-tailed bandage. But whoever has used them both will find, that in simple fractures of the humerus, the roller is not only more easily applied than the other, but that it answers the purpose better.

Fractures of the humerus commonly heal more kindly than similar injuries of any other part; and when properly managed, they seldom leave either lameness or distortion of the arm. When no interruption occurs to the cure, either from severe pain, swelling, or inflammation, or from accident or mismanagement, the bone will in general be firmly united in less than a month; but the limb should not be used with much freedom till the sixth or seventh week.

## SECTION

## SECTION X.

*Of Fractures of the Bones of the Fore-Arm,*

THE bones composing the fore-arm are two in number, the radius and ulna. From their being much exposed to accidents, they are very liable to fractures. When both bones are broke, the nature and seat of the injury are for the most part easily discovered; but when one bone only is fractured, especially if it be the radius or smaller bone, as the firmness of the other prevents it from being displaced, it requires some attention to discover it. The seat of the pain points out the injured part; and when either of the bones is fractured, a grating noise will be heard if the surgeon grasps the limb firmly above and below this



this part, and endeavours to move it in different directions.

In this examination, it is of much importance to distinguish the direction of the fracture with as much exactness as possible, particularly if it be near to the wrist; for upon this the chance of our making a proper cure in a great measure depends: and in this situation, whether both bones or only one of them be broke, the utmost nicety is required to prevent a stiff uneasy state of the arm from continuing long after the fracture is healed. It is not unfrequent, indeed, to hear patients complain of this inconvenience after these fractures during the remainder of their lives; and I think it is more apt to happen when the radius is broke by itself than when the ulna only is fractured, owing to this bone having a rotatory motion independent of the other, by which it is with more difficulty kept in its situation. And as there is nothing for which practitioners are more apt to be blamed than for those inconveniences

conveniences which patients suffer after the cure of fractures, we ought, in every case of this kind, to treat it with the utmost attention.

After discovering the seat of the injury, if any part of either of the bones be displaced, we ought, as soon as it can be done with propriety, to put it right. The patient being properly seated, and the muscles of the arm relaxed by bending the joints of the wrist and elbow, the limb should be extended to such a degree, by one assistant grasping it above the fracture and another beneath it, as is just sufficient to allow the surgeon to replace the bones with exactness. This being done, one of the splints represented in Plate LXX. fig. 3. 4. or 5. covered with soft flannel, and of a length to reach from the elbow to the tops of the fingers, and of such a breadth as to incase rather more than one half of the arm and hand, should be placed along the ulna. Another splint not quite so broad must be placed along the course of

of

PLATE. LXX.

FIG. 1.

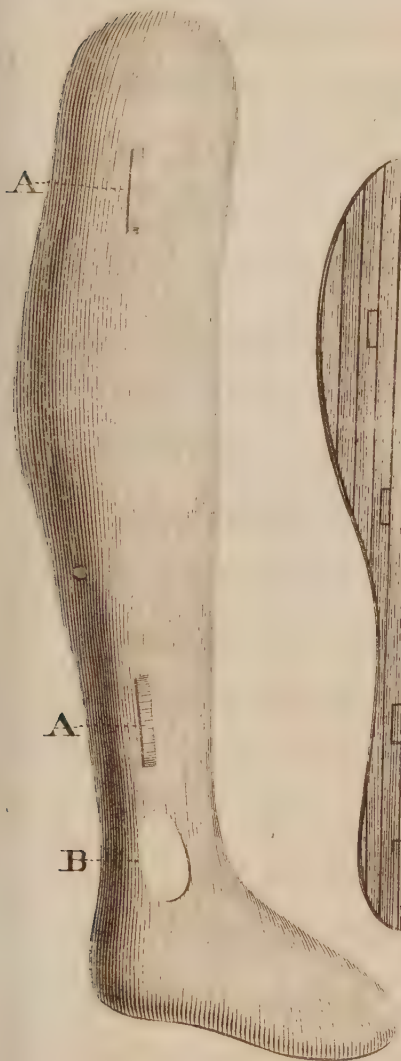


FIG. 2.



FIG. 3.



FIG. 4.

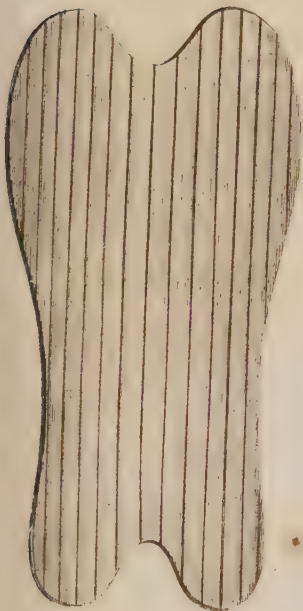


FIG. 5.



FIG. 6.







of the radius ; when both may be secured either with a flannel roller or a twelve-tailed bandage, of such a degree of tightness as to prevent the bones from slipping out of their place, but without impeding the circulation or giving the patient any uneasiness. The last mentioned bandage answers the purpose extremely well ; but the roller may be used in all simple fractures of these bones without any impropriety.

In applying the splints, the palm of the hand should be turned towards the breast, as being not only the most convenient posture in which the arm can hang while in a sling, but as being the best in which it can at all times be placed, even when the patient is in bed : for the palm of the hand can neither be turned upwards nor downwards ; that is, it can neither be put into a prone nor a supine posture, without giving that rotatory motion to the radius which we have mentioned, and which tends more than any other to displace any part of this  
bone

bone that is fractured. It ought, therefore, to be carefully guarded against; and I know of no method by which it can be done with such certainty as securing the arm with splints in the way we have pointed out. It must now be hung in the sling, represented in Plate LXXXI. fig. 1. and allowed to remain in the leather case during the night, or in any small box of a similar construction, and of a size just sufficient to receive the arm when placed upon its side, but without admitting of its turning either one way or another.

In speaking of the splints, I have advised them to be of a sufficient length for stretching along the whole course of the arm from the elbow to the top of the fingers. The under one ought more especially to be of this length: for the arm not only rests with more ease and equality upon a long splint, but it serves to cover the fingers, by which they are prevented more effectually than in any other manner from moving; a  
cir-



circumstance of much importance in all fractures of the fore-arm: for when a free motion of the fingers is permitted, it not only tends to keep up inflammation and pain, but is often the cause of the bones being again displaced, when otherwise they might have been kept in contact.

A partial dislocation of the bones forming the joint of the wrist, is not an unfrequent concomitant of a fracture of the radius; by which the risk of a stiff joint, or of a painful permanent swelling of the arm, becomes considerable. In such circumstances, it is therefore always proper to inform the patient of his danger: for even under the best management, a dislocation of the wrist, and a fracture of the contiguous bone, are apt to be productive of this effect. For the method of reducing the dislocation we must refer to the ensuing chapter; and we have already pointed out, in the first section of this chapter, the most effectual method with which we are acquainted,

of preventing and removing inflammation; which we have there shown to be the most frequent cause of that stiff immovable state in which fractured limbs are often left.

The olecranon, or upper end of the ulna, is sometimes fractured without any injury being done to the rest of the bone; this part of the bone being particularly apt to suffer from falls and bruises upon the elbow.

In this case, in order to keep the fractured parts in contact, the fore-arm must be extended: And with a view to preserve the arm steadily in this situation, a long splint should be laid along the fore-part of it, from the middle of the humerus to the tops of the fingers; and this being properly secured with a roller, the arm should be allowed to hang by the patient's side, to which it should be fixed by one or two straps.

It is proper, however, to remark, that the arm should not be kept long in this situation, otherwise a stiffness of the elbow

elbow-joint will very probably happen. With a view to prevent this, the bandage and splint should be removed about the eighth or tenth day ; when the fore-arm being for some time moved slowly backward and foreward, and the joint rubbed with any emollient oil, the arm may be again secured as before. A cautious and daily repetition of this practice, while it prevents the occurrence of a stiff joint, does not retard the cure.

## SECTION X.

*Of Fractures of the Bones of the Wrist, Hands,  
and Fingers.*

THE bones of the wrist being small, round, and somewhat moveable, readily yield to any ordinary force that may be applied to them. On this account, they



are seldom fractured except by shot from fire-arms, or a heavy weight passing over them.

The bones here are so small that they do not readily reunite. For this reason, as well as from the contiguity of tendons and ligaments, which gives rise to high degrees of inflammation, a complete ankylosis, or great stiffness of the joint, are common consequences of fracture of the bones of the wrist. After replacing the bones, nothing proves such an effectual preventative of these effects as copious blood-letting from the injured parts by means of leeches, in proportion to the violence of the symptoms and the strength of the patient: and this being done, the arm and hand should be supported by a splint put beneath them, with another above, in the manner we advised in the last section; and both should be secured by a similar bandage and sling.

In fractures of the metacarpal bones, after replacing them with as much exactness as possible, a firm splint, either of  
timber

timber or strong pasteboard, should be applied over the whole palms of the hand and inside of the arm, from the ends of the fingers to the joint of the elbow, in order to keep the hand as much extended as possible, as the flexor muscles of the fingers cannot be bent in any degree without altering the position of these bones; and in order to guard against this with as much certainty as possible, the long splints mentioned above, with a similar bandage, may be applied over the whole.

Fractures of the fingers are frequent; but when properly treated the bones readily unite, and the fingers become equally useful as before.

The best splint for a fractured finger is a piece of firm pasteboard exactly fitted to it, and softened in water till it is easily moulded into the form of the part. The finger being stretched out and the bone replaced, this splint should be applied along the whole length of it, and secured with a narrow roller: And in or-

der to prevent the injured parts from being disturbed, a large splint, either of the same kind of paste-board, or of a thin piece of wood glued upon leather, as is represented in Plate LXXI. fig. 3, 4, 5, or 6. should be applied over the inside of the hand; and the fingers being stretched upon it, another roller should be put over the whole, to secure the fingers and hand, so as to prevent them from having any kind of motion.

With a view to preserve the motion of the joints of the fingers, the bandage and splints should be removed about the tenth or twelfth day; when the several joints of the finger being cautiously bended and extended different times, the whole should be tied up as before: And this being repeated daily, the splints may with safety be removed at the end of the third week; when, by this piece of attention, the motion of the finger will be found complete, unless more than one bone has been broke, and at the same  
time



time so much splintered as to render this precaution impracticable.

## SECTION XI.

*Of Fractures of the Femur or Thigh-Bone.*

EVERY part of the femur is exposed to fractures : but it is more frequently broke near to the middle than in any other part of it ; and next to this, that part of it termed the Neck of the Femur is most apt to suffer.

Fractures of all the under part of the femur are for the most part easily distinguished, by the usual grating noise of the ends of the bone on their being forcibly rubbed together ; by the limb being much shortened if the fracture be oblique, or if the ends of the bone have been displaced in cases of transverse frac-

tures; by much pain and tension over the injured part; and by the limb being rendered unable to sustain the body.

It is often difficult, however, to distinguish fractures of the neck of the femur from dislocations of this bone. A due attention to the following circumstances will enable us in most instances to avoid mistakes of this kind, which are always attended with serious consequences.

In a great proportion of cases, perhaps in nineteen of twenty, the head of the femur when dislocated is pushed inwards and downwards, owing to the brim of the acetabulum being not so deep in this part as in others, as well as to the muscles at this particular part being not so strong; while perhaps in an equal number of fractures in the neck of the femur, the bone is pushed upwards, owing to accidents of this kind happening most frequently from falls upon the knees, or perhaps upon the feet when the legs are stretched out, by which a very considerable force is necessarily brought to act against  
the

# PLATE, LXXI.

FIG. 1.

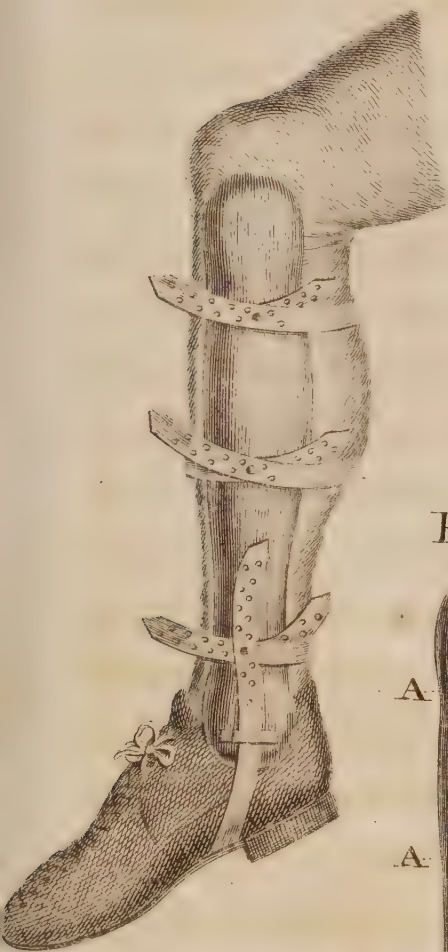


FIG. 2.

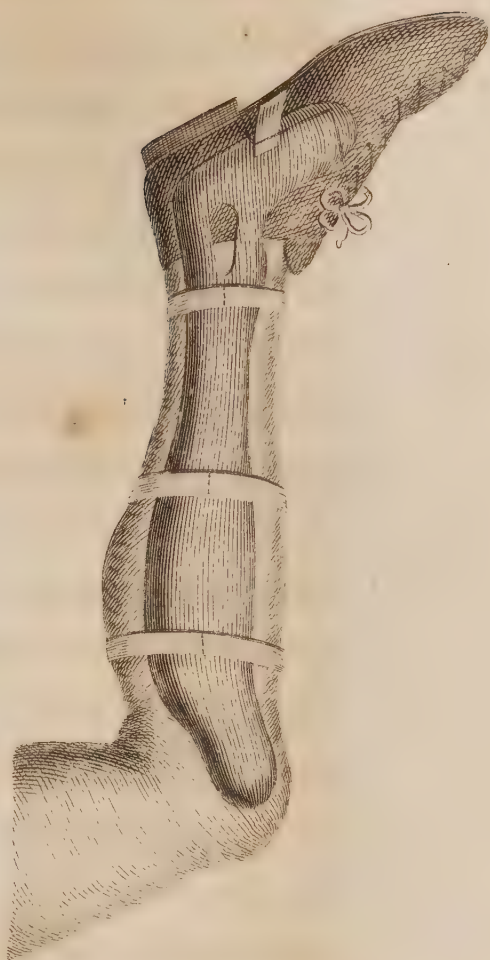
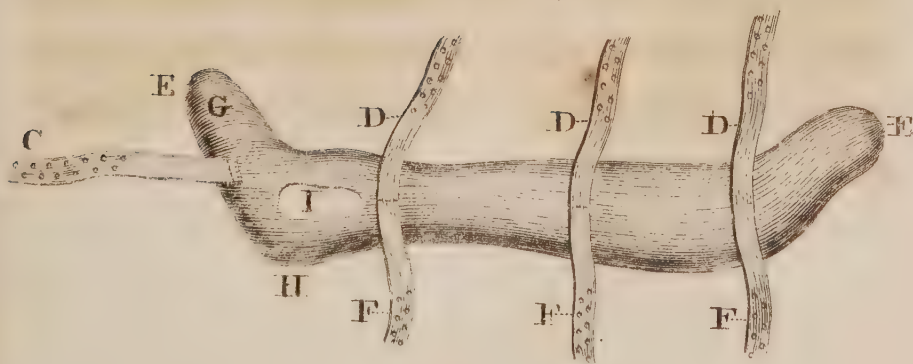


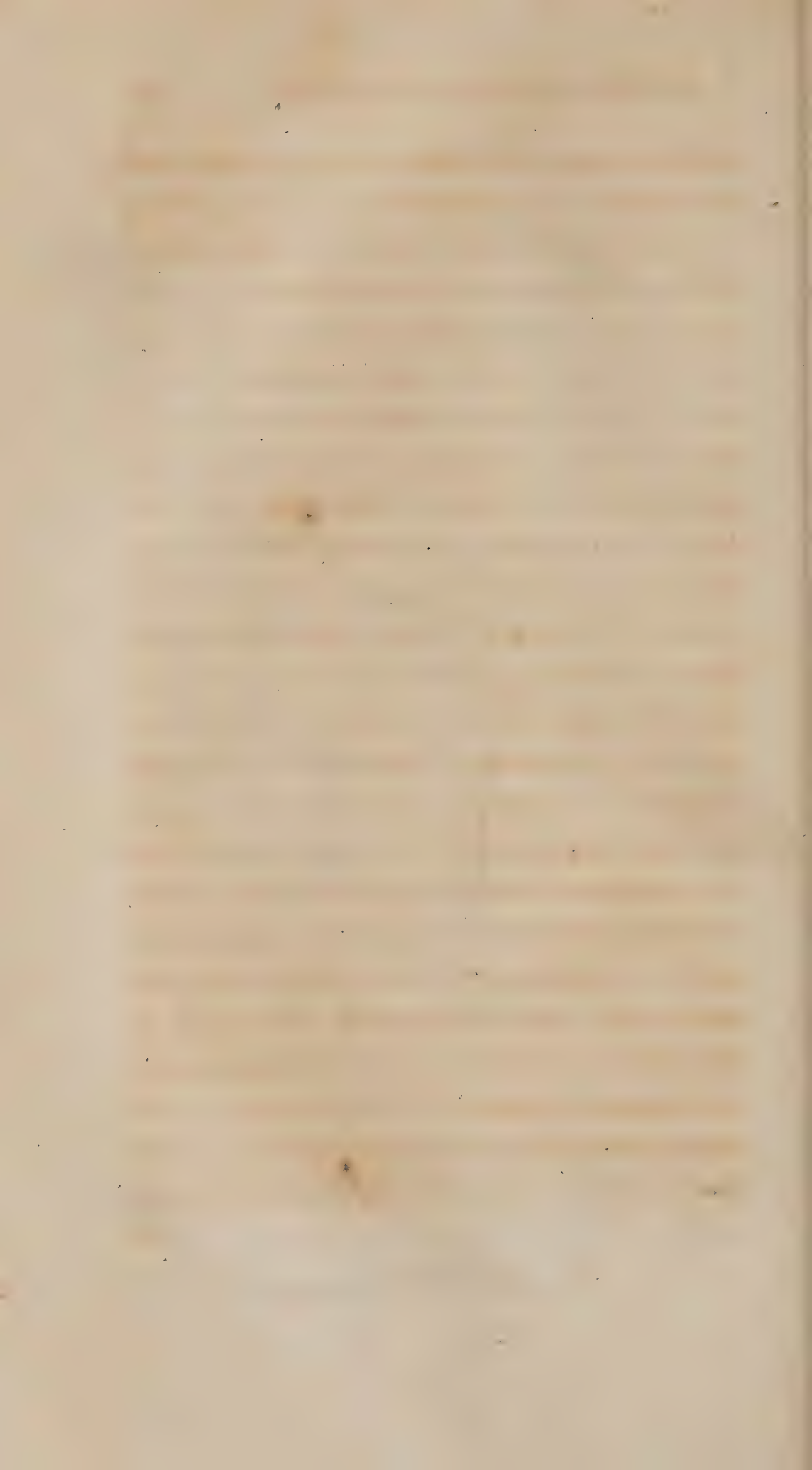
FIG. 3.



FIG. 4.







the neck of the thigh-bone, where it is least able to give resistance. In all such fractures, the leg is much shortened, often to the extent of several inches. The trochanter is accordingly found to be much higher than the trochanter of the other thigh; and the knee and points of the toes are turned inwards. On the other hand, in those dislocations of the thigh-joint which we have mentioned, the leg is considerably lengthened, the head of the bone and the trochanter are discovered near to the groin, with a corresponding vacancy where the trochanter ought to be, and the toes are turned out.

In every fracture, a grating noise is discovered on the ends of the bone being rubbed against each other; and in all fractures of the neck of the femur, it is observed that the leg and thigh may be turned with much more ease from one side to another, that is, the knee and foot may be moved with more ease outwards or inwards, than when the head of  
the

the bone is dislocated. We may likewise remark, that in dislocations the tumor formed by the head of the bone and trochanter together, must be always greater than in fractures, where the tumor is formed by the trochanter alone.

In no part of surgery are we more apt to be disappointed than in the treatment of fractures of the thigh, particularly where the neck of the bone is broke. This proceeds from various causes; all of which should be kept in view in forming a prognosis of the probable event of such cases.

1. The thigh-bone is so thickly covered with muscles and other soft parts, that it is often with difficulty we can discover the direction in which a fracture runs.

2. We must often, therefore, be uncertain whether the bones be rightly replaced or not; for where the course of a fracture cannot be ascertained with exactness, we can never be sure of this being precisely effected.

3. But



3. But even where we are able to accomplish the reduction of the fracture with the utmost nicety, we know from daily experience that it is extremely difficult to retain the bones in their situation with such exactness as to prevent deformity. For when a fracture is either seated in the neck of the bone, or runs obliquely in any other part of it, it is so difficult to prevent the bones from being displaced merely by the ordinary action of the muscles, that the limb is for the most part rendered considerably shorter than the other; for in all such cases, if the different parts of the bone cannot be so placed and retained as to support each other, the under part of it will very certainly be drawn upwards.

In fractures of the thigh too, other causes concur to render it difficult to retain the bones in their situation. They are more affected than fractures of other bones by every unusual exertion of the body; particularly by sneezing, coughing, and laughing; nor can the posture of the body

dy be in any way altered without affecting the thigh.

In the reduction of a fracture of this bone, much difficulty was formerly experienced from the position in which the limb was put during the operation. The body being placed either upon the floor, on a table, or in a bed, the limb was then extended, by which all the muscles connected with it were put upon the stretch; and as the extension was continued till the bones were replaced, when this was accomplished with difficulty, the muscles were often either violently tore asunder, or so much weakened as not to be afterwards fit for use; for some of the muscles of the thigh being among the strongest in the body, a very considerable force was required to overcome the resistance they afforded. But if the muscles of the limb are relaxed, by making the thigh form an obtuse angle with the body, while the joint of the knee is moderately bent, it is surprising with what ease we may, in most cases, place the bones  
in

# PLATE. LXXII.

FIG. 3.

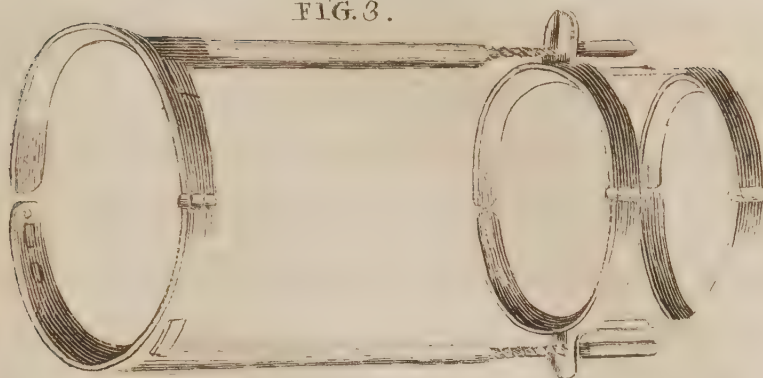


FIG. 4.

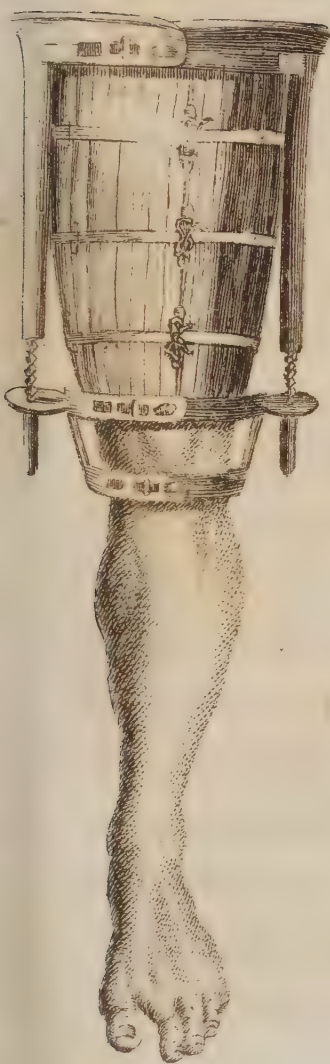


FIG. I.

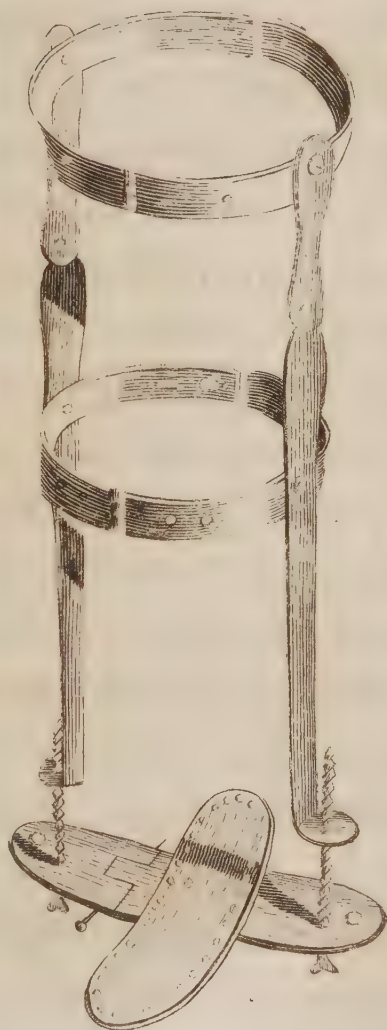


FIG. 2.



FIG. 5.







in their natural situation. The cause of resistance is thus almost entirely removed; so that if there be not much tension or swelling, the ends of the bone may in general be easily brought into contact, by one assistant securing the upper end of it, while the lower part of it is supported and gently drawn down by another, the surgeon in the mean time being employed in putting the fractured parts together with as much exactness as possible.

There is most difficulty in reducing fractures of the neck of the bone; for the muscles, in that situation, being exceedingly strong, and running in various directions, they cannot be relaxed so completely as those of other parts of the limb. But even here we may, for the most part, succeed in the manner we have mentioned, the body being secured by one assistant, while moderate extension is made by another at the lower part of the thigh. It is proper, however, that practitioners be provided with instruments

ments for more powerful extension when the method now recommended fails. Different instruments are delineated for this purpose in Plates LXXVI. LXXVII. and LXXVIII.; but these should never be employed till every attempt in the usual manner proves abortive.

It is not, however, in replacing the bones, but in retaining them when replaced, that we encounter the greatest difficulty. In transverse fractures of this bone the practice is very easy. After the fractured ends of it are brought into contact, they would for the most part support each other with sufficient firmness even without any bandage, if the patient could be confined to a proper posture: But to prevent any risk from sudden exertions, the limb should be as firmly secured with splints and a proper bandage, as is consistent with a free circulation through the injured parts.

For this purpose two splints are represented in Plate LXX. fig. 4. and 6. One to reach from the top of the hip-joint



to a little below the knee, of a breadth sufficient to cover at least one half of the thigh; the other to reach from the groin to a little below the knee, and in breadth covering about a third part of the thigh. Of these, covered with soft flannel, the longest laid upon a twelve-tailed flannel bandage, is to be placed upon a thin pillow nearly as long as the thigh. The patient being placed in a bed made as tight as possible with a firm hair mattrafs, so that it may not sink or yield, his knee being moderately bent, and the bones accurately set, the surgeon must order the pillow, with the bandage and splint above it, to be placed so as the splint may reach from the hip-joint along the outside of the thigh to the knee. That this posture of the leg and thigh may be easily preserved, the patient should not be laid directly upon his back, but turned somewhat towards the affected side; and the knee and leg should be raised rather higher than the body.

The

The limb being thus placed in the posture in which it is to be kept, the short splint mentioned above must be laid along the inside of the thigh from the groin to the knee, when the bandage previously placed beneath the other splint must be applied, of such a tightness as to make an equal moderate pressure over the whole thigh.

As the cure would be much interrupted, and might at last be very incomplete, were any part of the dressings to give way, it is a proper precaution perhaps in every case, to insert a long splint of firm timber beneath the middle of the pillow, and to secure it in its situation by two broad straps firmly buckled on the upper part of the limb.

To obviate the motion of the limb, in consequence of involuntary startings, the pillow should be fixed to the bed by straps; and to prevent injury or uneasiness from the weight of the bed-cloaths, two or three hoops fixed in a proper frame should be placed over the thigh.

When no untoward symptom occurs, the limb might be left in this situation till the cure was completed; but least the bones should by accident be displaced, and especially if the limb should swell and become painful, the bandage should be undone, and the upper splint removed, in order to admit of the parts being examined with accuracy. The twelve or eighteen tailed bandage admits of this being done without the limb being disturbed. In the event of pain, swelling, or inflammation, it may be proper, before renewing the dressings, to apply leeches and other remedies to the parts affected; but when none of these take place, and when the bones are found in their situation, the splint should be immediately replaced and secured with the bandage as before.

In healthy adults, when the cure proceeds without interruption, it will in general be completed in the course of six weeks; but violent exertion of every



kind should be avoided till the eighth or tenth week has passed over.

We have advised the limb to be placed in such a posture as tends most effectually to relax all the muscles connected with it. But although this may be highly proper at first; yet there is no necessity for persevering in it during the whole course of the cure. On the contrary, it proves often very prejudicial, as the limb, if it be kept unvariably in one posture for six or eight weeks, as is too frequently practised, is very apt to become stiff and unwieldy, so as to be afterwards productive of much uneasiness and distress. At the end of a fortnight, or even in less time than this, the patient may be allowed to turn more towards his back, and the joint of the knee may be somewhat stretched out. If this be done with caution, it may be repeated daily; that is, the leg may be alternately stretched out and bent; by which the motion of the whole limb will be much more free and  
entire

entire at the end of the cure than we usually find it to be.

In a great proportion of cases where cures are practicable, the mode of treatment we have here pointed out will prove successful. It will never fail in transverse fractures, if all the parts of it meet with proper attention: but altho' it will often succeed where the bone is broke very obliquely; yet it must be confessed, that cases of this kind sometimes occur in which it fails entirely, the ends of the bone slipping past each other, and the limb becoming much shorter than it ought to be, notwithstanding all our efforts to prevent it.

Indeed, an effectual method of securing very oblique fractures in any of the bones of the extremities, and especially of the thigh-bone, is perhaps one of the greatest desiderata in modern surgery. In all ages, the difficulty attending this has confessedly been very great; and frequent lameness from shortened limbs proceeding from this cause, evi-

dently shows that we are still deficient in this branch of practice.

The treatment of fractures being one of the most important branches of surgery, and to prevent lameness one of our first objects, much ingenuity has been shown in the invention of some method by which this purpose might be answered. It has been proposed, and by several practitioners has been attempted, in fractures of the thigh, to secure the patient's body, as one fixed point, by means of different bandages, to the upper part of the bed, and by an axis in peritrochio at the foot of the bed, to make such a degree of extension as might be fully equal to the purpose of retaining the fractured bones. But all who are acquainted with the fretful irritable state in which patients with fractures commonly are, and with the pain which tight bandages always excite, will know, that although proposals of this kind may appear to advantage in theoretical disquisitions, they will never probably be of  
real





# PLATE, LXXII.

FIG. 1.

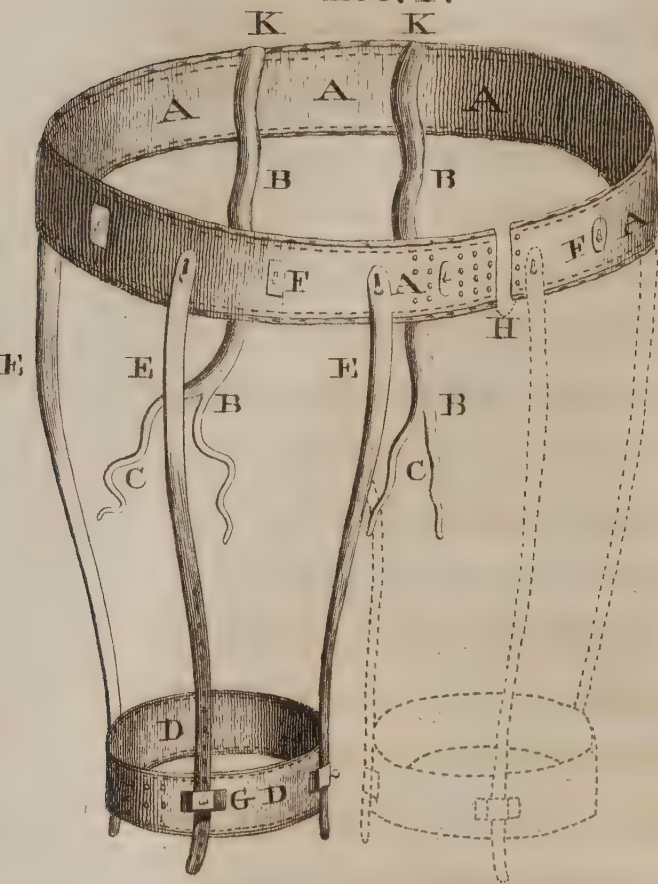


FIG. 2.

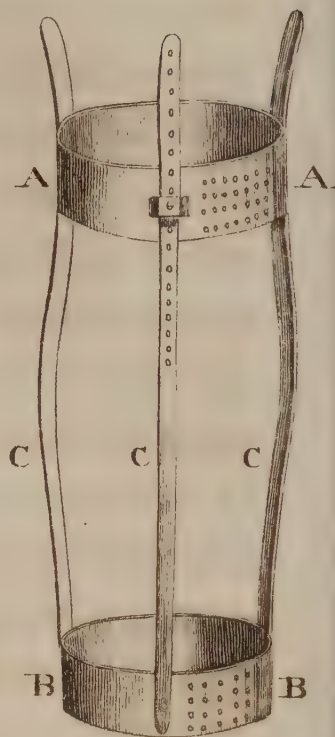
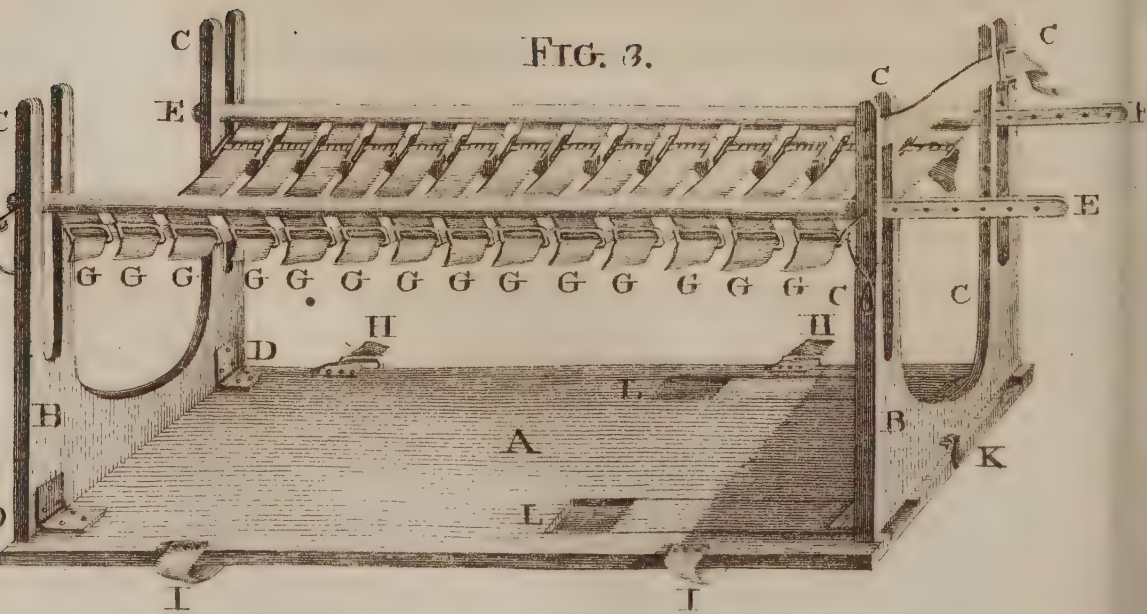


FIG. 3.



real utility. And accordingly none of them have ever been admitted into general practice.

The invention of the late Mr Gooch of Norwich, is the one which promises to be of the greatest utility in oblique fractures of the thigh. This instrument is delineated in Plate LXXII. and in an improved state by Dr Aitken in Plate LXXIII.

A broad firm strap of leather, lined with quilted cotton or soft flannel, is placed on the upper part of the limb, and secured by buckles of such a tightness as the patient can easily support. A similar strap is put round the under part of the thigh, and made to rest chiefly on the condyles of the femur. Two or three steel splints, connected with the straps, pass from one to the other in such a manner, that by means of them the straps can be forced asunder, and retained with the greatest certainty at any distance during the cure.

For a more particular account of this

H 3                      apparatus,



apparatus, the explanation of the plates may be consulted.

In some cases, however, the pain, swelling, and inflammation, are so considerable, as to preclude the application of the most simple bandage. After endeavouring to relieve the symptoms by local blood-letting and other remedies, Mr Gooche's method, or Dr Aitken's, may be adopted, if practicable; if not, the cure must be conducted in the usual way, with the hazard of the ends of the bone passing one another, and of the limb being shortened. But in this event, under the circumstances we have just mentioned, although the patient may regret his misfortune, he cannot with propriety or justice blame the surgeon.

## SECTION

## SECTION XII.

*Of Fractures of the Patella.*

THE patella or knee-pan is liable to fractures from falls and bruises upon the knee. Transverse fractures are most frequent; but we meet with instances of longitudinal fractures in this bone, and in some cases it is broke into three or four different pieces.

In fractures of the patella, we are in general desired to make a very guarded prognosis; as by most writers upon this subject, it is said that they almost constantly terminate in a stiff joint, owing, as is supposed, to the callus forming in too great quantity, and to its finding access to the cavity of the joint. I have not found, however, that fractures of this bone are so apt to produce stiff joints as

we are led to expect. In different instances which I have had of them, scarcely any degree of stiffness remained in any of them after three or four months: and when any permanent affection of this kind does take place, I cannot imagine that it proceeds from superabundance of callus, as the quantity which such a small bone will afford, must be extremely trifling. It rather seems to originate from the inflammation with which these fractures are usually accompanied affecting the internal parts of the joint; or from the knee being kept too long in an extended immoveable posture. From a dread of separating the fractured parts of the bone before they are firmly united, the leg is usually preserved in an extended posture for six, eight, or perhaps ten weeks; a much longer period than is necessary, and by which alone even the soundest joint would be apt to become stiff and immoveable.

In the treatment of fractures of this bone, in whatever direction they may  
run,



run, the leg should be extended, in order to relax the only muscles with which it is connected, those forming the ligament inserted into it. With this view, the patient should be placed upon a bed rendered so firm that it will not yield during the course of his confinement; a precaution particularly necessary in all fractures of the lower extremities, where long confinement to bed is almost always necessary, and where unequal sinking of the body is often the source of much uneasiness to the patient, and may be the cause of a separation of the newly replaced bones.

This being done, a long firm splint of timber, thickly covered with soft wool, or with several plies of fine flannel, should then be placed beneath the thigh and leg, from the upper part of the one to the extremity of the other; and to this the limb should be secured by two straps between the ankle and knee, and one or two between the knee and top of the thigh. This will effectually preserve the leg in a state  
of

of extension ; and it does it in the easiest manner when the splint is sufficiently broad and properly covered in the way we have mentioned.

The different parts of the fractured bone are now to be brought as nearly together as possible with the hand ; but no bandage is yet to be applied to them. Our great object at first is to prevent inflammation ; for which purpose as much blood should be taken from the joint by means of leeches as the patient can properly bear ; and for two or three days, or as long as much pain, swelling, or tension continue, saturnine and other astringent applications should be used for removing them.

This being accomplished, we again examine the state of the bone ; and if the different parts of it be all as nearly in contact as is necessary, they ought not to be disturbed. The joint may be covered with a large pledgit of Goulard's cerate, by which it will be kept soft and easy ;

easy; and a hooped frame should be employed to support the bed cloaths.

But if the different parts of the bone, instead of being nearly in contact, are found separated to any considerable distance, it becomes necessary, in the first place, to replace them, and afterwards to retain them with bandages as far as this can with propriety be done.

In a longitudinal fracture of the patella, this is easily accomplished; for in this direction we meet with little resistance in replacing them, and they are easily retained with very moderate pressure, either with the common uniting bandage, or with slips of leather spread with glue or adhesive plaster. But in transverse fractures of this bone, as that portion of it connected with the extensor muscles of the thigh is apt to be drawn forcibly upwards, we cannot always replace it; or if this is practicable, it cannot always be retained in contact with the inferior portion, but by a force that  
would



would excite pain, swelling, and inflammation.

It is a fortunate circumstance, however, that it is not absolutely necessary to a complete cure, that the different pieces of bone be kept in exact contact. Where it can be easily done, it ought always to be put in practice; but I know from the result of several cases where this was impracticable, that a cure may be obtained, and the joint be equally firm and useful as it was before, even although the separated portions of bone cannot be brought within an inch of each other. We should not therefore be very anxious about this; and instead of using much force for the purpose of drawing the bones into close contact, no more should be employed than the patient can bear with perfect ease.

Various bandages have been invented for drawing the divided parts of a fractured knee-pan together; but all of them have been formed upon erroneous principles. They are made to press equally upon

upon the upper and under portion of the bone: whereas the least reflection on the anatomical structure of the parts must render it obvious, that no advantage can be derived from much pressure on the inferior part of the bone, which always remains in its natural situation; and therefore, that any force we employ should be almost entirely applied to that part of it connected with the ligament of the extensor muscles; by the action of which, particularly of the rectus muscle, this portion of the bone is drawn upwards.

In Plate LXXV. a bandage is represented; from which, while it fits easily upon the parts to which it is applied, every advantage which can be expected from this kind of assistance may be derived. It consists of two circular straps, A B, of firm leather, lined with soft flannel, with two perpendicular straps C E, that pass from one to the other, and a femilunar firm compress G; with another strap of a greater length D, reaching  
from

from the point of the toes to the buckle on the upper circular round the thigh; as is more particularly represented in fig. 3. of the same Plate:

The leg being extended and elevated to a proper height for relaxing the extensor muscles of the thigh, the upper edge of the under circular strap A should be applied to the under part of the inferior portion of the bone, so as to support it in its natural situation without forcing it further up. The strap must be then buckled to such a degree of tightness as the patient can easily bear it; and the upper half of the bone being pulled gently downwards, the femilunar compress F in fig. 3. must be applied round the upper end of it, when the upper circular strap must be also buckled. By means of the two perpendicular straps and buckles, we now make an easy gradual extension, which will not move the under circular if it be made sufficiently tight; but which will draw the other downwards if it be not made too tight, which we ought carefully to endeavour to avoid. This will,



in some degree, draw down the upper part of the bone, by gently pulling down the compress previously applied to the upper end of it; but it will be more effectually done by the strap D made sufficiently tight by fixing it to the corresponding buckle in the upper circular strap B.

In this manner the different parts of the bone may be made to approach each other as far as this can be done with propriety; but for the reasons already mentioned, the pressure should never be carried so far as to endanger the excitement of pain, inflammation, or swelling.

The limb being secured in the manner we have mentioned, the bandages should not be removed till the twelfth or fourteenth day, if pain and inflammation do not render a more early removal necessary. But about this period the joint should be exposed, when the limb may be moderately bent; and this being cautiously repeated every second or third day, no interruption will be given to the cure, while the motion of the joint will  
be

effectually preserved; which it seldom or never is when this piece of attention is neglected.

There is another injury to which the joint of the knee is liable; so similar in its effects to the one we have been considering, and in the mode of treatment, that I think it right to mention it here; namely, a separation, by external violence, of the ligament or tendon of the rectus muscle from the patella. The usual effect of a smart stroke, or a severe fall, upon the fore-part of the knee, is a fracture of the patella: but where a person carrying a heavy burden upon his back, falls with his knee much bent, a rupture of the tendon is a more frequent consequence; at least I have met with three cases of this accident from this cause, in which the tendon, after separating from the bone, retracted to the distance of two or three inches.

The treatment we have advised for a fracture of the patella proves equally successful here: Only it will be under-

stood, that in this case no advantage can be obtained from pulling down the retracted tendon: for no part of the bone being connected with it, we cannot lay hold of it; so that we have to trust solely to the extended posture of the limb. But although the tendon and bone cannot be brought close to each other, yet a cure may always be accomplished in the manner we have mentioned.

## SECTION XIII.

*Of Fractures of the Bones of the Leg.*

**I**N fractures of the leg, one bone only is often broke; but a fracture of both is more frequent. In this case the seat, as well as the direction, of the fracture are readily discovered. When one bone only is broke, these are discovered



with more difficulty. This, however, is of no great importance ; for when one of the bones remains entire, it serves so effectually to support the other, that nothing is necessary for effecting a cure but confinement till the fractured bone be united.

Fractures are more frequent near the joint of the ankle than in other parts. We find a great proportion of fractures of the fibula seated an inch or two above the under extremity of this bone, this being the weakest part of it.

In the management of a fractured leg, the same general principles apply which we advised in the treatment of a fractured thigh-bone. In replacing the bones, the muscles of the limb should be as much relaxed as possible ; and we do it in the most effectual manner by bending the joint of the knee and slightly extending the foot. When the leg is in this position, there is seldom much difficulty in putting the bones into their natural situations ; and with no more ex-  
tension

PLATE. LXXIV.

FIG. I.

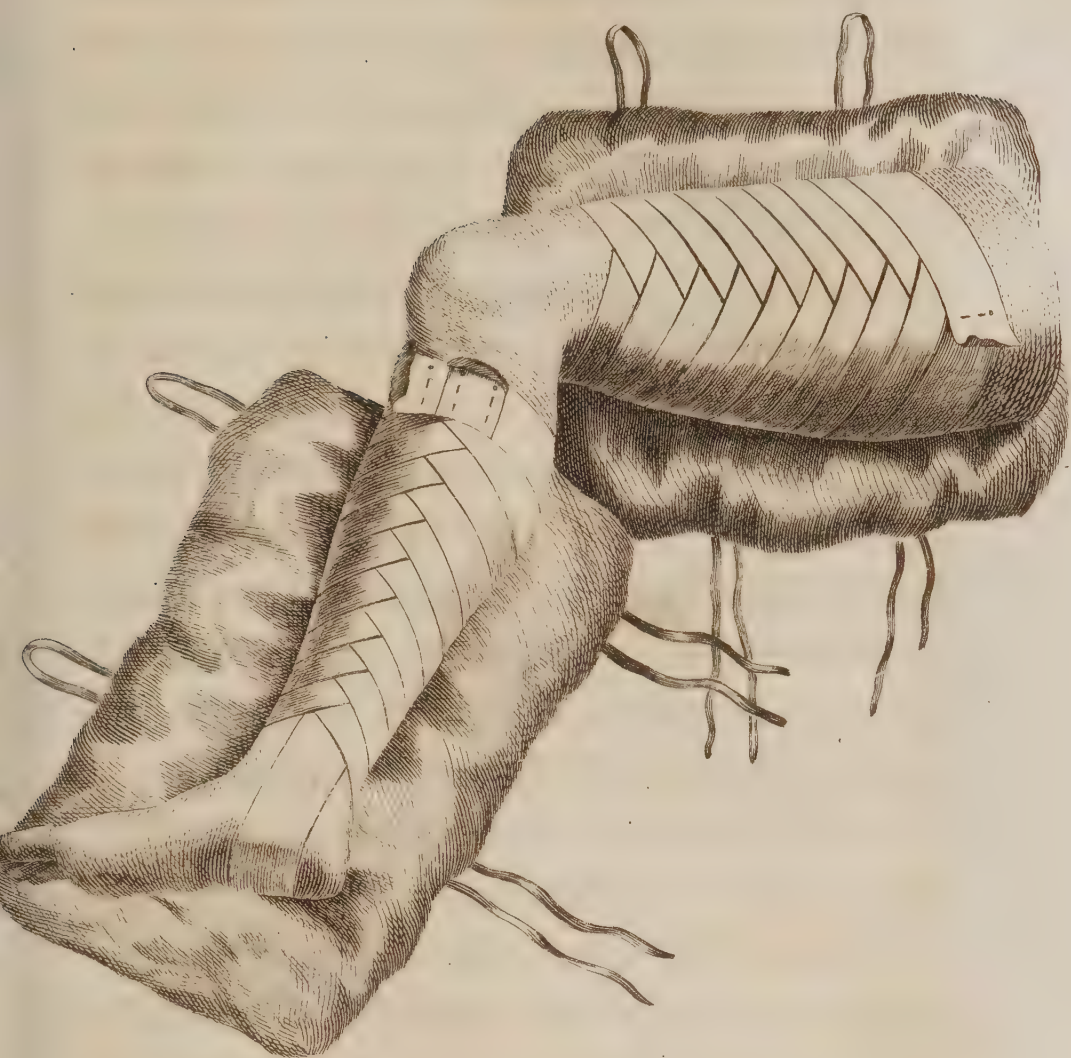
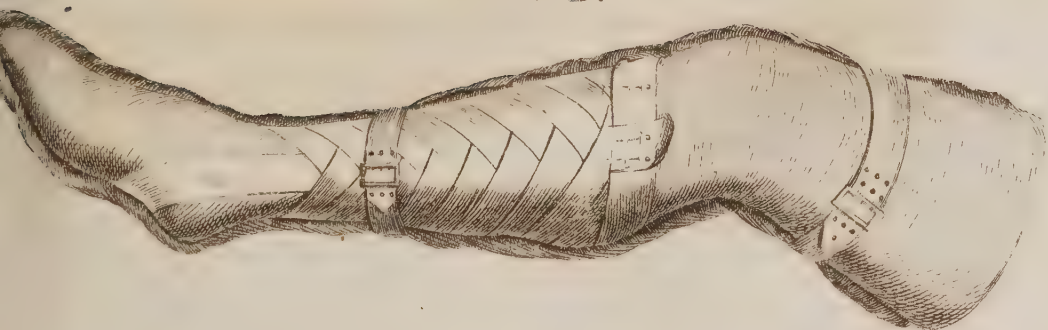


FIG. 2.







tenfion than can with great eafe be given, by one affiftant at the upper end of the limb, and another fupporting it at the ankle.

This being done, and the patient placed in fuch a manner that the injured leg may with eafe be laid upon its outfide, with the knee bent, the fplints, figs. 3, 5, or 6, Plate LXX. fhould be applied and retained with the twelve-tailed bandage; the fplint on the outfide of the leg reaching from a little above the knee to beneath the ankle, with a view to prevent the motion of either of thefe joints, by which the bones are apt to be difplaced.

Whether the fplints are of firm pafte-board, or fuch as are represented in Plate LXX. they would, for the moft part, prove fufficient: but when the patient is either very reftlefs, or troubled with fpafmodic affections of the mufcles of his leg, an additional fplint of wood, fhaped to the form of the leg, as is represented in figs. 1, and 2, of the fame plate, fhould be applied along the outfide of it; and

if it be slightly excavated and filled with soft-wool, it fits with perfect ease, while it prevents, with the utmost certainty, the ends of any of the bones from falling downwards. It is fixed with any degree of tightness by two straps and buckles. The leg, when dressed in this manner, has the appearance represented in Plate LXXIV. fig. 2.

We have already observed, that after the dressings are applied, the leg should be laid upon its outside, with the knee bent, and the foot should be somewhat supported by a turn of a bandage, as represented in the figure just mentioned. The intention of this is to relax the muscles of the limb; by which the patient lies with more ease, while the bones are less liable to be displaced, than where the muscles are kept fully stretched out, as was almost the universal custom till very lately.

But although it is proper to place the leg in such a posture as tends most effectually to relax all the muscles; yet the  
knee

knee should not be more bent than is necessary for this purpose: for when the joint is much curved, it is almost equally irksome to the patient as when the leg is fully stretched out. The knee should not therefore be more bent, nor should the patient be laid more towards the affected side, than is just necessary for allowing the leg to be placed upon its outside.

There are some patients, however, who, from long custom, as well as from other causes, cannot rest when lying on either side; and some practitioners think, that fractures of the leg mend better when the patient is laid upon his back, and the limb placed upon the gastrocnemii muscles, with the toes upwards. In such cases the patient may be placed upon his back, and yet the curved position of the leg retained. This may be done in different ways; but the easiest method is, by raising the leg, and supporting it upon a frame, at a proper height above the level of the body. This ad-



mits of the limb being placed in the posture we have mentioned, and with any necessary degree of curvature.

Even where a fractured leg is placed on the outside, it is a pleasant variety to the patient to have the posture altered; and by means of such a frame it can be easily done.

A limb placed in this situation is represented in Plate LXXX. fig. 2. This variety of posture is even admissible in fractures of the thigh. The patient may from the first be placed with his leg curved in the manner here represented; or he may afterwards turn upon his back, and the cure be completed while he remains in this posture, or he may alternately change from one to the other. The inconveniency usually complained of, from the leg resting upon the heel when it is stretched out, is avoided by an excavation or opening made in the bottom of the frame for receiving the heel; or it may be done by allowing the heel to project over the edge of the frame altogether.

altogether. No change of posture, however, ought to be permitted for the first ten or twelve days. About this time the patient may be turned with caution upon his back, and the leg moved from one position to the other, care being taken to preserve it in the same degree of curvature.

In fractures of the leg where the fibula only is injured, it is apt to pass unnoticed, and to be considered as a sprain of some of the muscles : But as very serious consequences are apt to ensue from this mistake, it ought to be strictly guarded against.

When treating of fractures of the clavicle, we had occasion to mention an appearance which, of itself, is extremely simple and of easy treatment ; but which, from want of attention to the cause of it, has often been productive of much perplexity both to patients and practitioners ; I mean what is commonly termed the Rising End of a Bone : and as this

I 4 frequently

frequently occurs in the leg, I think it proper to mention it here.

When the bones of the leg are broke directly across, they sometimes serve to support each other so effectually that neither of them are displaced. In such circumstances no inequality appears in the limb, if it be not from some temporary swelling of the soft parts. But when both bones are fractured, and at the same time displaced, the under extremity, or that portion connected with the foot, is almost always drawn towards the back part of the leg; by which an unequal prominency is produced by the projecting end of the upper portion of bone, or that part of it which still remains connected with the knee.

It is this which in general is termed the Rising End of the Bone: and in reducing such fractures much pains has often been taken to force a bone in this situation into contact with the others. It is obvious, however, that it is not the upper part of the bone which rises, but the  
the





PLATE LXXV.

FIG. 1.

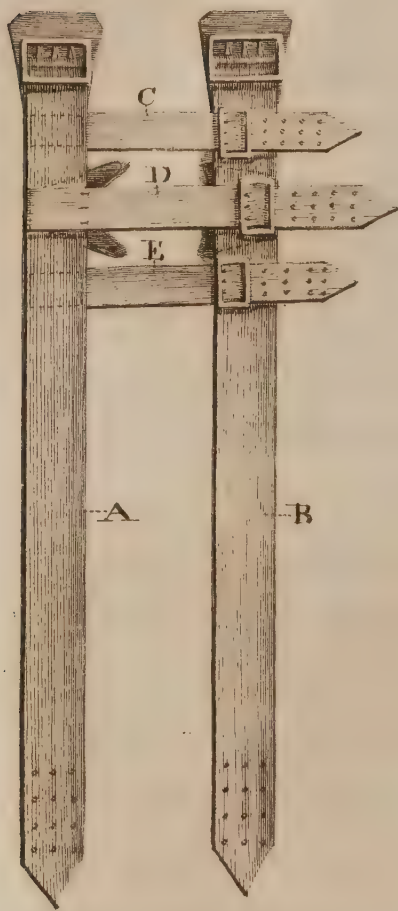


FIG. 2.

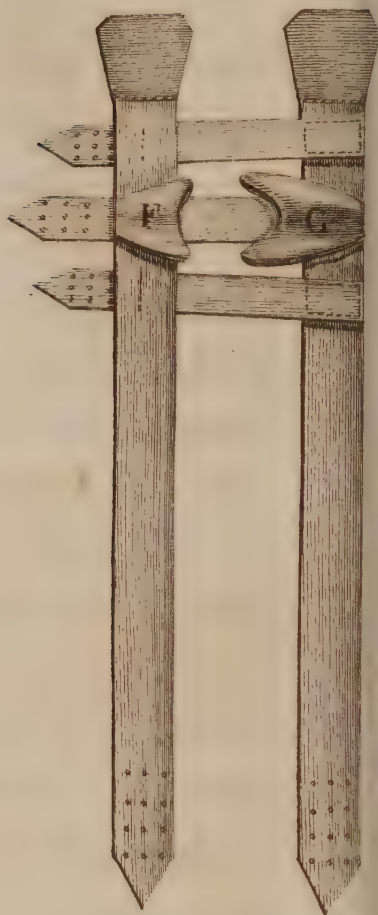
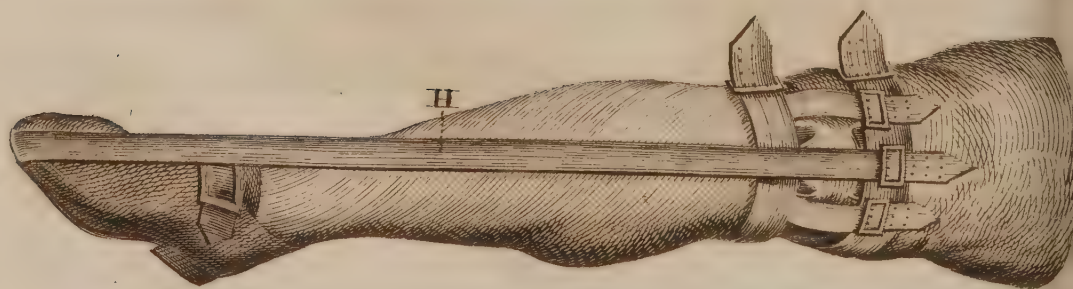


FIG. 3.



the inferior portion which falls, or is drawn out of its natural situation by the weight of the foot, as well as by the contraction of the muscles on the back part of the leg: Hence no advantage can be gained by any pressure made upon the superior part of the bone, while much harm may be done by it; as has often happened by bandages being put so tight upon it as to cut all the teguments with which it was covered; and thus forming a compound fracture of what otherwise would have remained of the most simple kind.

The upper part of the bone never rises out of its natural situation; so that any inequality that occurs on the form and appearance of the leg must be produced in the manner we have mentioned, namely, by the inferior portion of the bones being drawn out of the situation which they ought to occupy: so that in our treatment of such affections, instead of forcing down the upper part of the bone, our sole object should be to raise the inferior



ferior part of it, so as to bring them into contact; and by supporting it in this situation, to endeavour with as much certainty as possible to effect their reunion. In this manner a cure may be often accomplished, which would not in any other way have been practicable.

#### SECTION XIV.

##### *Of Fractures of the Bones of the Foot and Toes.*

THE foot is very liable to injuries of this kind from a variety of causes; but particularly from its being more exposed to bruises than other parts of the body.

Fractures of these bones are distinguished in the same manner with fractures of other parts. We judge that one or other of them may probably be fractured

red when the foot has been violently bruised ; and we discover with certainty that it is so by the grating of the fractured parts when they are rubbed against each other.

Fractures of the bones of the foot and toes are to be managed nearly in the same manner with similar injuries of the hands and fingers. Any portion of bone that is displaced must be put into its natural situation with as much exactness as possible ; and we endeavour to retain it by a splint fitted to the form of the part supported with different turns of a roller. When any of the bones of the foot are fractured, a large splint should be applied over the sole so as to support the whole of it ; and no freedom should be permitted in the motion either of the foot or ankle during the cure, for nothing tends more to displace a fractured portion of bone than the action of contiguous muscles.

## SECTION

## SECTION XV.

*Of Compound Fractures.*

AS the term Compound Fracture has been applied to injuries of different kinds, I think it right to define with precision the meaning I wish to affix to it. A fracture of a bone communicating with an external opening or wound in the corresponding teguments, I denominate a Compound Fracture. It is not the circumstance of a fractured bone occurring with a wound in the contiguous soft parts that constitutes a compound fracture: This may happen with a fracture of the most simple nature. Unless the external opening communicates with the fracture of the bone, the nature of the injury is not affected by it, even although



though the wound be extensive ; while the smallest puncture passing directly to the substance of a fractured bone, adds much difficulty to the method of cure, and hazard to the event.

Compound fractures are produced by external violence, and frequently by the bones, in cases of simple fractures, being pushed through the corresponding teguments. In some cases, this happens from a bone being fractured so very obliquely as to terminate in a sharp point ; while in others it is an evident effect of too tight a bandage, applied with the improper view, as we have seen in one of the preceding sections, of bearing down the upper end of the fractured bone. But in whatever way a compound fracture is produced, the consequences resulting from it are nearly similar. The admission of air to a fracture adds evidently to the risk attending it ; and whether this takes place as an immediate effect of external violence, or as the consequence of pressure upon the ends of the bone, no difference is

is perceptible in the effects which result from it.

Various reasons might be adduced to prove that it is the admission of air alone which renders compound fractures more hazardous than others. We may shortly mention, however, one of the most obvious proofs of it. The worst variety of simple fracture, where the bone is broke in the most oblique manner, and where it is difficult or perhaps impossible to retain it in its situation, will continue to do well, and to excite no severe symptom, as long as the skin remains entire: But if, by any accident, the point of the bone is pushed through the teguments, from that moment the pain becomes more severe; the inflammation, which before perhaps was trifling, becomes now considerable; fever takes place; the limb is apt to be attacked with violent spasmodic twitchings; and to these there frequently succeeds either gangrene or extensive suppurations.

In compound fractures, our first object

ject is to restrain profuse hemorrhagies when they take place, by a proper application of the tourniquet : Our next is to consider, whether we are to attempt to save the limb, or to recommend immediate amputation.

From the difficult treatment and uncertain event of compound fractures, practitioners have been very universally disposed to consider the amputation of the fractured limb as indispensably necessary. At all times indeed individuals have opposed this general opinion. Among others, Mr Bilguer of Berlin wrote on this subject ; and he asserts, that amputation is scarcely ever requisite, and that a greater number of patients would recover by proper treatment than by the operation.

To me it appears that both opinions are in the extreme ; and that they have been formed without that attention to, and discrimination of, circumstances, which the importance of the question required.

In



In private practice, where patients can be kept quiet and perfectly at rest from the date of the injury, and where proper attention can be insured on the part of the practitioner, as well as of experienced nurses, compound fractures should receive a different treatment from those that happen in a field of battle or in an engagement at sea. There are so many instances in which, from amputation being objected to by the patient, from the limb being too much swelled or inflamed before assistance was called to allow of its being performed, or from intention on the part of the practitioner to endeavour to save the limb, of cures being made, that I am now convinced that immediate amputation should never be advised in private practice, unless when the bones are so much shattered that they cannot reunite; or where, from the violence of the injury, the texture of the soft parts is completely destroyed.

*On the treatment of compound fractures.* On

On the other hand, I am satisfied that it would be a good general rule, both in the navy and army, to amputate immediately in every case of compound fracture received in battle, where the accident is either in the humerus or thigh, or where both bones of the fore-arm or leg are broke. In this situation, the patient is exposed to a variety of hardships which tend to aggravate his danger; and no accommodation can be procured nor attention given to lessen it.

In opposition to this it may be alleged, that many cures of compound fracture are daily made in military hospitals. Indeed this is the argument on which Mr Bilguer rests his opinion: but, like every prejudiced inquirer, he states it partially.

I readily admit, as every one accustomed to the treatment of fractures will do, that cures are sometimes unexpectedly accomplished under the most untoward circumstances: But the favourable termination of a few cases ought not to

invalidate a rule of such consequence as this, which is founded on the sure basis of experience and observation.

When an officer of rank and fortune receives a compound fracture, and where circumstances admit of his being soon conveyed to comfortable quarters, with a prospect of his remaining there during the cure, the case must be a bad one if we do not attempt to save the limb. But cases of this kind are not in the usual routine of military practice; and I mention them particularly, because the accounts we have received of the success of the practice inculcated by Mr Bilguer, are chiefly, if not entirely, drawn from such instances; and they therefore afford no conclusion relative to military and naval practice in general.

Even in private practice, I am far from thinking that our attempts to save fractured limbs will always succeed. I know they will not; and, in the course of much business, that cases will occur in which the best conducted measures will fail,



fail, particularly where the large joints are much injured, and where the long bones are not only fractured but broke into splinters in different places: But I know from experience, that in a great proportion of the whole we will prove successful; and that in those cases in which we are at last obliged to advise amputation, more will recover than probably would have done if the operation had been performed soon after the accident: at least this has been very commonly the case in the course of my observation. Of those who have died soon after the operation, either from the fever induced by the extensive wound; from the great and sudden change produced in the circulating system by the removal of a considerable part of the body; or from the perturbation and violent agitation of spirits which the unexpected loss of a limb must always induce, a great proportion has been of those cases where the operation was performed as quickly as possible after the accident. In these the various causes

we have mentioned concur to render the subsequent fever, and every concomitant symptom, more violent than we commonly find them in patients who have been reduced by confinement and a low regimen, and who, from having full leisure to reflect upon the danger of their situation, are, from their own conviction of its being necessary, very readily induced to submit to the operation.

A patient may indeed be brought so low as to make the success of the operation doubtful from this cause alone : But a practitioner may always guard against this by proposing the operation when his attempts to save the limb prove abortive, and when the patient's strength declines.

Amputation proving more successful in the more advanced stages of compound fractures than when practised immediately after the accident ; and in the more advanced stages of chronic affections, particularly in white swellings of the joints, as we have elsewhere remarked, than in the more early periods of them ;

# PLATE LXXVI.

FIG. 1.

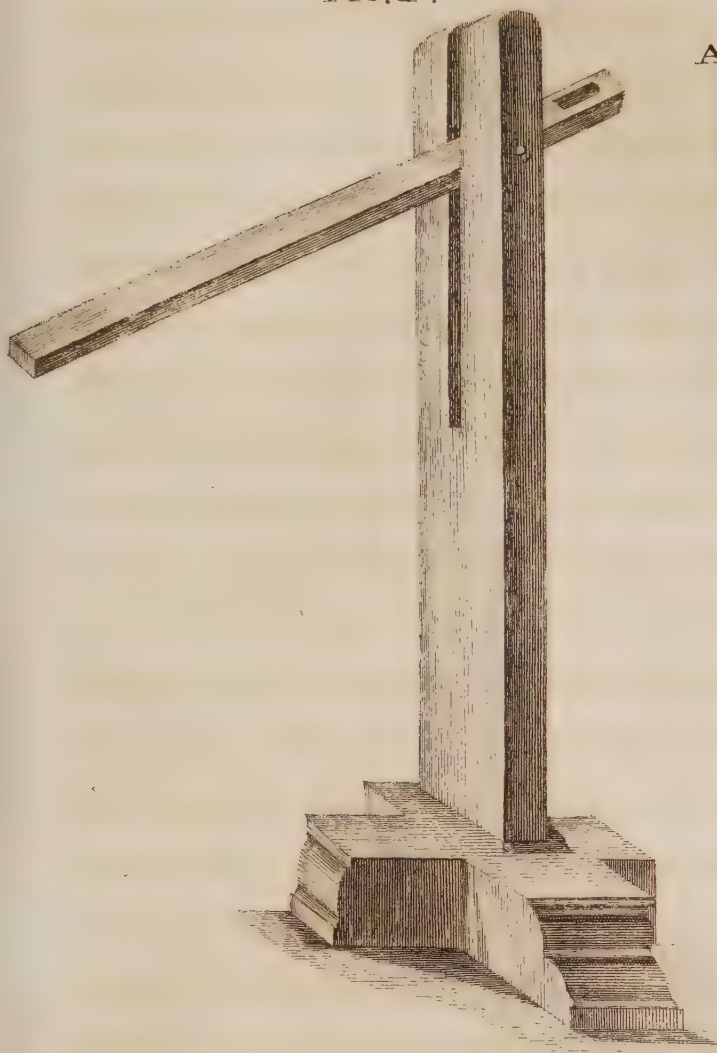


FIG. 2.

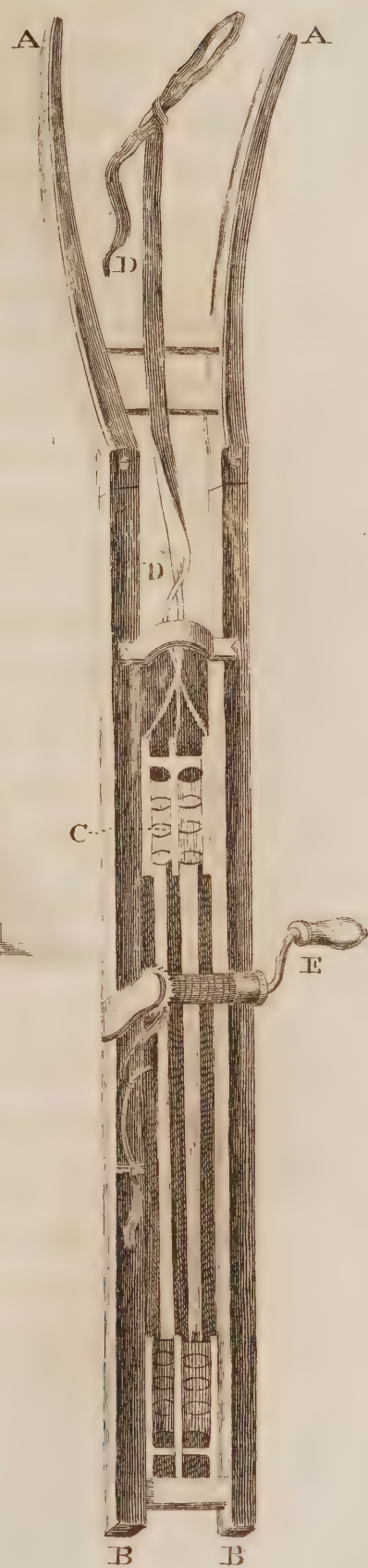


FIG. 3.







them ; is a point which merits the attention of practitioners. So far as my observation goes, I consider the fact as ascertained ; and if the experience of others leads to the same conclusion, it will prove the most convincing argument against early amputation. In the course of my own experience, I do not recollect an instance of death occurring from the operation alone, where the affection for which it was advised was of some duration ; and in several instances it has been performed where the patient was very much exhausted : Whereas several have died merely from the operation, where it has been put in practice soon after the accident. When I speak of death as the consequence of the operation, I do not mean such instances of it as occur from hemorrhagies breaking out in the course of a short time after the patient is laid in bed, as these may happen at whatever period a limb may be amputated ; but such as take place about the second or third day, and in some instances at a la-

ter period, from the violence of the fever induced by and commencing soon after the operation.

When amputation is not performed immediately, or soon after the injury is received, it is agreed upon all hands, that it cannot, for several days at least, be admissible. Different causes may afterwards render it necessary.

1. Hemorrhagies under certain circumstances.

2. Extensive mortification.

3. The ends of the fractured bones remaining long disunited, while a copious discharge of matter endangers the sinking of the patient's strength.

When hemorrhagies take place immediately, we have it always in our power to command them, either by compression alone, or by enlarging the wound when it is too small, and securing the bleeding arteries with ligatures. Sometimes, however, when no discharge of importance occurs at first, profuse hemorrhagies will take place at the end of several days. It  
may



may be difficult in some cases to account for this ; but we can frequently trace it to the effect of friction ; the coats of an artery being destroyed by beating or rubbing upon the sharp edge of a splint-ered bone.

Even in this advanced state of the injury we may frequently be able to secure the wounded arteries with ligatures. But the limb is sometimes so much swelled and inflamed before the hemorrhagy appears, that the original opening will not admit of this ; and on proceeding to enlarge it, such confusion is met with from effused coagulated blood between the interstices of the muscles, as well as through the whole cellular membrane of the affected parts, that the divided arteries cannot be all brought into view, but by such extensive incisions as in this state of the parts would be attended with more hazard than amputating the limb at a proper distance above : and although it is not a common occurrence, yet instances happen where the most expert sur-

geons are obliged in this situation to amputate.

Mortification is the second motive we mentioned for amputating in this stage of compound fractures; and, when it takes place to any considerable extent, it must be allowed that it is a very powerful one. We shall have occasion to consider this subject, however, more particularly when we treat of amputation; and with respect to the third cause we mentioned, when the bones do not unite, and when the patient declines under a copious discharge of matter, no practitioner of experience will, in this situation, dispute the propriety of amputation.

It is this state of a compound fracture, when the original inflammatory fever excited by the injury is subsided, and before the patient is too much weakened by the discharge, which of all others we consider as the most favourable for amputation. The exact time cannot possibly be fixed by any general observation.

tion. It must depend upon the particular circumstances of every case, and chiefly upon the quantity of the discharge and strength of the patient; and these again are points which the judgment of the practitioner in attendance can alone decide upon. We may remark, however, that as long as the patient does not seem to be much hurt by the discharge, however great it may be, the operation should not be advised; for while his strength is not much impaired, we may with safety proceed in our endeavours to save the limb.

From what has been said, it will appear, that, in private practice, very few cases can occur of compound fractures, in which we should not attempt to save the limbs.

In the treatment of compound fractures, our object is the same as in the management of those of the most simple nature; namely, the replacing of any bones that may be deranged, and retaining them till they are united.

In



In the first place, all extraneous bodies should be removed, as well as all those small pieces of bone that will not probably unite with the rest; for which purpose the opening should be enlarged with a scalpel, if it be too small to admit of their being easily taken out. And this being done, we will in general find it an easy matter to replace the bones if we relax all the muscles of the injured limb in the manner pointed out in the preceding sections of this chapter. There is just one exception occurs to this: A sharp point of a bone is, on some occasions, so far pushed through the teguments, that it cannot be replaced by any ordinary force; and to a certain extent, the greater the force that is applied to it, it is the more firmly fixed between the skin and parts beneath. In such cases there are two methods by which the difficulty may be removed: By sawing off the end of the protruded portion of bone, or enlarging the wound.

When a long sharp point of bone is  
much

much protruded, we should not hesitate in removing it; for although it should be reduced, it would not readily unite with the rest of the bone, at the same time that it would be apt to excite much pain and irritation. When the portion to be taken away is very small, it may be done with the cutting forceps usually employed in amputations: but when it cannot be easily done in this manner, it may with safety be taken off with a saw; a piece of paste-board, or of thin sheet-lead, being previously inserted between it and the teguments beneath.

But whenever the protruded portion of bone is broad at the base, and not of any considerable length, as there will be cause to hope that it will unite with the rest of the bone if they be brought rightly into contact, we ought certainly to endeavour to save it; and in general we will be able to do so by enlarging the opening through which it has passed. If we take care to avoid any large blood-vessels and nerves, which those acquainted with the  
anatomy

anatomy of the parts will readily do, no danger will occur from the operation. Instead of adding to the danger of the patient, it tends often to lessen it, by removing a powerful cause of pain and irritation, and thus preventing that inflammatory tension to which limbs in this situation are particularly liable.

To those not much accustomed to treat compound fractures in this manner, the practice we now recommend may be supposed to be attended with hazard; and to convert a small puncture into an extensive wound, may often appear to be cruel and unnecessary. But as the admission of the air has already occasioned all the mischief which can arise from this quarter, we do not thus increase the danger of the patient; and it is generally well known, that a free incised wound heals more readily than a small punctured one. It is the skin only which, in most cases, we have to cut here: But even where the bone cannot be easily reduced without carrying the incision in-

to



PLATE LXXVII.

FIG. I.



FIG. 2.



FIG. 3.





to the substance of the contiguous muscles, we should not hesitate in advising it: Only, in this case, the opening should be made as much as possible in the direction of the fibres of the muscles.

The splinters of bone, coagulated blood, and other extraneous bodies being removed, any artery that may be cut being secured with a ligature, and the protruded portion of bone replaced, the fracture is, in other respects, to be reduced in the manner we have advised when speaking of simple fractures; that is, by relaxing the muscles of the limb, and extending the bones no more than is altogether necessary. This being done, a pledgit of soft lint, spread with any emollient ointment, should be laid over the wound, when the limb should be placed upon a firm splint, and still kept in a relaxed posture. As it is of much importance that the wound be regularly dressed without moving the limb, it should, if possible, be so placed, that this can be done; and with the same view, the many-tailed



tailed bandage, in every instance of compound fracture, where it is any respect applicable, should be preferred to the roller.

As it is a point of the utmost importance to place the limb in such a posture as will admit of the sore being dressed without moving it, various inventions have been proposed for rendering this in every case practicable. Very few of these, however, have answered the purpose for which they were intended. The best I have met with is a fracture-box invented by the ingenious Mr James Rae of this place; of which, with some improvements made by his son Mr John Rae, I now give a delineation. The leg may be laid in it either bent or straight, and a wound, wherever situated, may be dressed without altering the position of the limb, as will be more clearly understood from the representation of the instrument, Plate LXXIII. fig. 3.

In whatever situation the limb be placed, it is an object of the first importance

ance to endeavour to prevent inflammation: for when mortification ensues, it may be almost always traced to too great a degree of inflammation; and the same cause very often gives rise to those extensive abscesses with which fractures of this kind are apt to be accompanied. We are therefore from the first to guard against the accession of this symptom; by one or more general blood-lettings, proportioned to the strength of the patient; by the application of leeches to the edges of the sore, when the inflammation becomes severe; by the use of opiates; by gentle cooling laxatives; a low regimen; and other parts of an antiphlogistic course. The dressings should be removed once or twice daily, according to the quantity of matter; and instead of dry lint, pledgits of any emollient ointment, or Goulard's cerate, will be preferable: for I have not found in any state of these sores that ointments do harm; and they always sit easily, and

are more easily removed than when dry lint is applied alone.

Warm emollient poultices are very commonly applied at first, and continued for a good many days. But as they prove always troublesome, and cannot be removed without in some degree altering the posture of the limb, I think it better to avoid them till we see whether or not they become necessary by the approach of inflammation. In that event they should be immediately employed as the surest means of exciting a discharge of matter: For although we would rather wish the sore to heal by what is termed the First Intention, without the formation of matter; yet this being a very unusual occurrence in wounds attending compound fractures, and a plentiful discharge of good pus being the most certain preventative of mortification, we should not hesitate in endeavouring to promote it whenever a limb with a compound fracture is attacked with inflammation.



As soon, however, as our views are accomplished, by the inflammation subsiding, and a free discharge of pus excited, the poultices should be laid aside: for in many instances, when too long continued, they have certainly done harm, by relaxing the parts too much, and exciting too profuse a discharge of matter.

When matter is discharged from a compound fracture in too great quantities, besides laying aside the use of emollient poultices, we ought to dress the sore with gentle astringents, such as soft lint dipped in a solution of saccharum saturni; and the patient should now be supported with a nourishing diet, a free use of wine, Peruvian bark, and elixir of vitriol. A free vent should be procured for the matter; and when this cannot be obtained by putting the limb in a proper posture, it should be done by making a counter opening in a more depending part. The necessity, however, of this may often be prevented by em-

ploying soft lint, or covering the fore with soft sponge to absorb the matter, and by frequent dressings : for although the sores should never be more exposed to the air than is necessary, yet whenever the discharge is copious, there will be more risk from allowing the parts to be long immersed in matter than from the most frequent renewal of the dressings.

When the discharge from a compound fracture becomes excessive, and cannot be lessened by the means we have mentioned, it will often be found to originate from a portion of loose bone that has not been earlier noticed. In such circumstances, therefore, we should always examine the fore with as much attention as possible ; and wherever a piece of loose bone is discovered, we ought to take it out either at the fore itself, or by a counter opening if it appears that in this manner it can be more easily done. In making an examination for this purpose, the finger alone should be employed

employed when the opening is so large as to give it access : for in this manner we do less harm than with a probe ; and at the same time we discover the real state of the parts with more precision. When it is necessary to use a probe, it should be done with caution, for much mischief is frequently done where this instrument is employed too freely.

If, instead of producing a discharge of matter, the inflammation should terminate in gangrene, the situation of the patient becomes still more hazardous than under the most extensive abscesses. We have elsewhere had occasion to treat of the subject of gangrene ; and we must now refer to that part of the work \*. In a following chapter, we shall have an opportunity of mentioning the period, at which amputation of limbs, attacked with gangrene, should be advised.

In considering this subject, some will suppose that I should have given more particular directions for securing frac-

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tured

\* Vide Treatise on Ulcers, &c. Part I. Chap. III.



tured limbs in their situation, especially in cases of compound fracture: But as I know of no method of effecting this with such certainty and ease as the one I have described, I consider it as unnecessary even to enumerate the various means that have been proposed for this purpose. In particular circumstances, those we have described in the eleventh section of this chapter, Mr Gooche's machine, and Dr Aitken's, may prove useful for keeping the fractured bones extended; and much advantage may certainly be derived from them in keeping the bones steady when it is necessary to move a patient with a fractured limb from one part to another: but in ordinary practice, I can without hesitation say, that no advantage is derived from any instrument I have ever known used for this purpose.

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C H A P. XL.Of LUXATIONS.

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## SECTION I.

*General Remarks on Luxations.*

**A** BONE is said to be luxated where that part of it forming a joint is displaced. In some cases the end of a bone is forced entirely out of the cavity where it is naturally lodged: This we term a Complete Dislocation. Where

any part of the bone rests upon the edge of the socket, we say the Dislocation is Incomplete.

Luxations may with the same propriety as fractures be divided into simple and compound. Where the end of a bone is merely displaced, we term it a Simple Luxation; but where this is accompanied with a corresponding wound in the soft parts, laying open the cavity of a joint, we say the Luxation is Compound. By some practitioners the term Compound is applied to dislocations accompanied with fractures of the contiguous bones, whether the teguments be injured or not. We say with more propriety, however, that a luxation in such circumstances is of a Complicated Nature.

For the most part luxations are produced by external violence, and appear as the immediate consequences of some considerable force applied to the injured parts. They are particularly apt to occur in leaping and falling, from blows,  
and



and violent twists and distractions of the different bones of a limb: But they are also produced by other causes; by a morbid weakness or relaxation of the ligaments and muscles of a joint, which sometimes occur as the consequences of palsy and long-continued rheumatic affections; and by the end of a bone being pushed from the cavity in which it was lodged, by matter collected in it, or by sarcomatous tumors and exostoses.

Those cases of dislocation that occur from external violence, are chiefly the objects of surgery. The symptoms usually induced by these, are, inability to move the injured limb; pain, tension, and deformity in the part affected; and in some cases inflammation, subfultus tendinum, and fever.

In general, the motion of the limb is impaired in proportion to the extent of the luxation; but in some cases, even the most partial affection of this kind renders the joint perfectly stiff and immovable, and creates the most exquisite pain

on every attempt to move it. This is particularly the case in partial dislocations of all the large joints.

The deformed or altered appearance of a joint, with which a luxation is always accompanied, must necessarily be in proportion to the extent of the injury ; but this is not the case with the other symptoms we have mentioned : for sub-sultus tendinum, inflammation, and fever, are often excited to a greater height by partial dislocations, where the ends of bones are not much moved from their natural situations, than where they are altogether forced from their sockets, owing to a circumstance which we shall presently endeavour to explain.

The first approach of swelling in cases of dislocation is always of the inflammatory kind, and is a necessary effect of the violence done to the injured parts. This, however, should be distinguished from a secondary swelling to which these affections are liable, an extensive tumefaction which in some cases spreads over  
all

all the under part of the limb, and which seems to originate from a different cause. Instead of being red, tense, and painful, the teguments are pale, soft, and œdematous ; owing, I suppose, to the lymphatic vessels of the limb being compressed by the end of the displaced bone. Swellings of this kind are most frequent in dislocations of the humerus and femur ; in which also considerable numbness or diminished sensibility is apt to be excited by the compression of the nerves of the limb.

It is of much importance to distinguish dislocations from other affections of the joints, and to ascertain to what extent the bones are moved from their situations. In compound luxations the nature of the injury is obvious ; and for the most part it is sufficiently evident in cases where bones are completely dislocated ; but partial dislocations are often not to be discovered but by the most minute examination : They therefore frequently pass unnoticed, or are considered as sprains



sprains and contusions ; and thus, in cases where complete cures might be performed by due attention on the part of the practitioner, patients are often rendered lame and miserable for life.

The symptoms enumerated above are common to all dislocations. In speaking of particular luxations, we shall have occasion to mention the peculiarities of each, and shall endeavour to do it in such a manner as may with most certainty prevent such unfortunate occurrences as we allude to.

In forming a prognosis of the event of luxations ; that is, of the practicability of reducing them, and of the termination of the symptoms with which they are attended ; various circumstances require attention : The form and structure of the different joints ; the nature and extent of the luxation, together with the degree of violence by which it was produced, and the circumstances with which it may be complicated ; and lastly, the duration of the injury.

The

The skeleton is commonly had recourse to for a knowledge of the joints; but although it is proper that every student should be acquainted with the articulations in a dry state, we should by no means rest satisfied with this. In the treatment of luxations, it is equally necessary that we have an exact knowledge of the joints in a recent state: Of the cartilages, ligaments, and tendons, with which the bones are connected, as well as of the contiguous parts in which the heads of the displaced bones may happen to be lodged: Otherwise our ideas of the nature of these injuries, and of the means that will most probably prove successful in the treatment of them, must be very imperfect.

We cannot enter upon a minute description of every joint, as it would lead to an extent of discussion inconsistent with the nature of this work. Referring to the proper sources for more particular information, we shall here only observe, that it is chiefly those joints  
that

that are possessed of much motion in which we meet with luxations. Of these there are two varieties. The one termed the Junction by Ball and Socket, where the head or end of one bone is received into the cavity of another; and the other termed by anatomists Ginglymus, or the Hinge-like Joint, from its resemblance to the hinge of a door. In this the joint is formed by different parts of one bone being received into cavities or indentations of another. The former admits of the most extensive motion, as is exemplified in the joint of the humerus with the scapula, and in that of the femur with the ossa innominata; while the latter does not admit of more than that of flexion and extension, as is the case in the elbow and knee. In these we accordingly find, that this more limited motion to which they are confined, renders them less liable to luxations; while the free motion of the others exposes them to frequent injuries of this kind, as is more particularly the case in the joint.



joint of the humerus, from the cavity in which the head of that bone is lodged being of no great depth.

Besides the usual coverings of teguments, muscles, and tendons, in common to joints with the rest of the body, every joint possessed of much motion is provided with what we commonly term a Capsular Ligament ; which is a firm somewhat elastic substance, forming a kind of pouch or bag, which completely furrounds the articulation, and serves at the same time to retain the ends of the bones together, and to contain a thin transparent fluid, the synovia, for the purpose of lubricating the cartilages which cover the ends of the bones.

Practitioners are not agreed whether in cases of luxation the capsular ligaments are ruptured or not. As it has appeared on dissection in a few instances that the ligament was ruptured, some have concluded that it is the case in all ; while others are of opinion, that the ligament always remains entire, except  
where

where the luxation has been the consequence of very severe and unusual degrees of violence.

The result of my observation on this point is, that partial luxations may happen without any rupture of the capsular ligament : but that it is always ruptured in complete luxations produced by external violence ; nay, that it is often almost entirely tore from its insertion round the neck of the bone. Where the head of a bone is gradually pushed from its socket by the slow formation of a tumor within the joint, and where the ligament is perhaps much relaxed by disease, a luxation may no doubt happen without either rupture or laceration ; but we cannot suppose that such a firm substance as a ligament is in a state of health, will yield, without bursting, to the sudden impulse produced by the complete dislocation of the head of a bone, and where the displaced bone is in some cases almost instantaneously forced to the distance of several inches from its  
2 natural

natural situation. Different instances are upon record of this opinion being supported by the dissection of dislocated joints after death ; and were it necessary, I could add others that have fallen within my own observation.

We mentioned above, that the pain attending partial dislocations is commonly very severe on any attempt being made to move the joints. For the most part, indeed, it is more exquisite than it usually is where the luxation is complete ; and we conclude that it proceeds from the capsular ligament being overstretched, and from the ends of the displaced bones continuing to act against it instead of passing freely through it.

In judging of a luxation, the distance to which the head of the displaced bone is forced, and the degree of violence by which it was produced, require particular attention. Where a bone is only partially dislocated, although the pain attending it may be very acute, yet the reduction of it will be accomplished both  
with



with more ease and certainty than if the same bone had been forced completely out of its situation. And where the joint has not suffered any extraordinary violence, the inflammation and other concomitant symptoms will not prove so formidable as they commonly do where the capsular ligament and other soft parts have been much stretched, or otherwise severely injured.

One of the most unfavourable circumstances with which a luxation is ever attended, is a fracture of one or both of the bones concerned in it. Even a fracture of the displaced bone is always a disagreeable occurrence, and this especially if it be broke near to its neck, as in this case it can scarcely be laid hold of for the purpose of reducing it; but the risk attending it is much more considerable when the bone forming the socket into which it should be received is also broke: for we know from experience, that fractures of these parts are more apt to be attended with severe degrees

grees of inflammation, as well as with extensive suppurations, than fractures of any of the long bones. And when the socket is broke, there is always much hazard of the joint being rendered stiff for life, even when the reduction of the displaced bone is accomplished in the easiest manner.

A dislocation being more or less recent, is the next point requiring our attention: for we know that luxated bones are, *cæteris paribus*, more easily reduced soon after they are displaced than when much time has elapsed. While the injury is recent, the bone will necessarily pass with more ease along the parts which it has just traversed, than it possibly can do after lodging several weeks or months among the contiguous muscles; where the head of it, instead of being loose, as is usually the case at first, will have formed a socket for itself, and will probably be firmly grasped by some of those muscular fibres which more immediately surround it. At this period too, the cavity

from whence it was dislodged may probably be in some degree filled up by the contiguous soft parts: Not that the synovia ever becomes inspissated, so as to produce this effect; for although this has by many been supposed to happen, and various means have been proposed for preventing and removing it, yet we now know that the opinion is ill founded. No inspissation of this fluid has ever been discovered by dissection, although stiff joints, where this state of the synovia was previously considered as the cause, have often been laid open for the purpose of detecting it. But although the cavity of a joint may not be filled up in consequence of any particular affection of the synovia, there is much reason to suppose that in course of time it will be diminished by the constant action of the contiguous muscles; which will not only force the cellular substance, fat, and other soft parts with which it is covered, into it, but may even have some effect in compressing the bone itself,



self, or the cartilaginous brim with which the bone is usually covered.

These are the circumstances in dislocations which more particularly require attention; but we have also to remark, that the patient's age and general state of health influence the reduction of a dislocated bone. Dislocations are more easily reduced at some ages and in particular habits of body than in others. Thus, in advanced periods of life, and in weak delicate constitutions, where the muscles give little resistance, displaced bones are more easily moved than in the vigour of youth and in robust habits of body, where the superior strength of the muscles has a considerable effect in preventing it.

In the treatment of dislocations, the objects we have in view are, to put the bone that is displaced into its natural situation, with as much ease and expedition as the nature of the case will permit; to retain it in this situation till the injured parts have recovered their tone;

and to obviate pain, inflammation, and any other symptom that requires attention.

Before proceeding to the reduction of a dislocation, we should examine the contiguous soft parts, to see whether they be in a fit situation for it or not: for although the sooner the operation is attempted, the more certain we will in general be of succeeding; yet whenever the surrounding teguments and muscles are much contused and inflamed, it is better to allow the pain and swelling that takes place to subside before any trial is made for reducing the bone; at least I have always been in the practice of this. I never observed any bad consequences ensue from it; and I have known much mischief done by a limb being much stretched while the parts surrounding a dislocated joint have been in an inflamed state.

In such circumstances, therefore, we should endeavour, by local blood-letting with leeches, by the use of saturnine applications,

plications, by a low regimen, and putting the limb in an easy relaxed posture, to remove the inflammation before any attempt is made for reducing the bone.

In almost every dislocation it is one bone only that is displaced, the other bone or bones of which the joint is formed remaining in their natural situation; and it will be found perhaps universally, that it is the bone connected with the inferior part of a limb that is forced from its situation, the bone forming the upper part of the joint, if it be not fractured, being seldom in any respect altered: In the reduction therefore of a luxation, the only attention we have to give to the upper part of a limb, is to keep it firm and steady, while we endeavour by the easiest and most effectual means to replace the under part of it.

A person not acquainted with anatomy, might be led to suppose that this may always be readily accomplished; as he will be apt to conclude, that the same degree of force which pushed a bone out



of its place, will with equal ease replace it. This would no doubt be the case were it the bone only that we had to act upon, or if it was merely connected with inorganic matter that would not give any resistance to the means employed to reduce it: But every joint being either partly surrounded by, or much connected with, muscles, the contractile power with which they are endowed acts with much force and advantage against every attempt that is made for the reduction of the bone; for they not only draw it beyond the end of the contiguous bone against which it ought to be placed, but they often pull it out of its natural direction, and fix it firmly in some neighbouring cavity, from whence it is dislodged with difficulty; while the stimulus created by every trial we make for replacing the bone, is apt to excite a further exertion of the muscles, and increases the difficulty which accompanies the reduction.

It is therefore obvious, that in the reduction of every dislocated bone, the muscles

cles with which it is connected should be put as much as possible into a state of relaxation; for in this situation, the resistance they give to the force employed for moving the bone is inconsiderable, when compared with what is required for the same purpose when they are kept in a state of extension. In the one, it is usually done with ease, both to the patient and surgeon; while in the other, that is, while a limb is much stretched or extended, it is with the utmost difficulty that a dislocated bone can be moved.

By relaxing all the muscles of a limb, we may in general obtain as much force as is requisite for reducing a luxation merely from assistants; but in some instances more is required than can be applied in this manner: In such cases, various instruments have been proposed for increasing our powers of extension: Some of which, and perhaps the most useful, are delineated in Plates LXXVII. and LXXVIII.

But whether we find it necessary to use machines of this kind or not, no more force should be ever employed than is just requisite ; and it ought always to be applied in a slow gradual way, by which there is much less risk of any harm being done, than when the muscles of a limb are forcibly and suddenly stretched: And it will also be understood, that the whole force used for the reduction of a dislocated one, should be applied to that bone only, and not to any other part of the limb.

Besides the resistance arising from the action of the muscles, we sometimes meet with a good deal of difficulty from the projecting end of a dislocated bone having passed that of the contiguous bone. In this case the extension is to be made in such a direction as will best obviate this occurrence.

In extending a limb for the purpose of reducing a dislocation, it is absolutely necessary to carry the extension so far as to dislodge the displaced bone, and to bring



bring the end of it on a line with the end of the other to which it is to be opposed, otherwise no advantage will be gained by the operation: for while any part of one bone projects past the extremity of the other, no means we can employ will be able to replace it, unless a sufficient force be applied to it, as has sometimes happened, for breaking off the projecting part; while, on the contrary, the reduction is always accomplished in the easiest manner, as soon as the displaced bone is drawn freely past all the projecting parts of the other: nay, when the end of a displaced bone is brought to this situation, it would be difficult to prevent it from passing instantaneously into the situation where it is naturally lodged. So that in the reduction of dislocations, our chief object is to make a sufficient degree of extension in the easiest manner, when the ordinary action of the muscles will for the most part replace the bone: Or when this fails, the most

most gentle pressure will be sufficient for the purpose.

The dislocated bone being reduced, there is seldom any difficulty in retaining it in its situation, unless it has often been displaced before: The surest means of effecting it is by putting the limb into a relaxed posture, and supporting the bone that has been just replaced with a proper bandage, till the surrounding soft parts have recovered their natural tone.

The symptoms that prove most urgent in dislocations, both before and after the bones have been reduced, are, pain, inflammation, and swelling. For the most part they abate after the reduction is completed; but while any degree of inflammation continues, repeated applications of leeches should be advised as the most effectual remedy: and as this symptom is to be considered as the cause of all the others, as well as of those chronic pains which joints are liable to that have ever been dislocated, it requires particular attention. But having considered this subject

ject very fully when treating of contusions, we must refer to Chap. XXXVII. Section II. § 2. for what was then said upon it.

In the first part of this section, we have said that luxations are sometimes combined with fractures of the displaced bones. When a bone is fractured at a considerable distance from the luxated joint, we may for the most part be able to reduce the luxation immediately, when the fracture should be treated in the usual way: But when a bone is fractured so near to the luxation that it cannot be laid hold of, the case is thereby rendered both difficult and uncertain. In the smaller joints, as in those of the fingers and toes, the displaced portion of bone may in some instances be pushed into its situation; but in all the larger joints, particularly in the hip-joint, and in that of the shoulder, we must first allow the fracture to heal, and the union of the fractured bones to be perfectly firm, before we attempt to reduce the luxation.



In compound luxations, that is, where joints are not only luxated but laid open by external injuries, the treatment we have advised in compound fractures will prove equally applicable. Indeed the nature of these affections is so similar, that almost all the observations made upon the one will apply with nearly equal propriety to the other: so that at present we shall refer to Section XV. of the last Chapter, where the subject was particularly considered.

We may just shortly observe, that after the luxated bones are replaced, and the limb laid in a proper posture, our next object is to prevent inflammation; which we do with most certainty by copious blood-letting with leeches applied as near as possible to the injured parts; dressing the sores with Goulard's cerate, or any other mild ointment; moderating the pain with adequate doses of opiates; and a low regimen.

This being done, we have to endeavour to prevent any matter from lodging a-

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bout

bout the joint, by placing the limb in such a manner as will not readily allow it to run off: if this fails, by dressing the fore more frequently, and absorbing the matter with a bit of sponge; or, when the quantity of matter is considerable, by a counter-opening made in a depending situation.

When mortification takes place, it is to be treated in the manner we have advised, when speaking of this subject in a former publication\*.

All that we have hitherto said relates in general to luxations produced by external violence. When they proceed from the heads of bones being pushed from their sockets, either by tumors of a fleshy or osseous nature, or by collections of matter, they may almost in every instance be considered as incurable: When the joint is so situated that the diseased parts can all be removed, this measure should be advised; but when this cannot be completely

\* Treatise on the Theory and Management of Ulcers, &c. Part I. Section III.

pletely effected, all that art should attempt is, to give as free a discharge as possible to any matter that may form, and to support the constitution with a proper diet, to prevent it from being too much reduced by the discharge.

Dislocations are sometimes the consequence of too great a relaxation of the ligaments and tendons which serve to connect the bones in a healthy state. This relaxation is seldom so completely removed as to prevent the bones from falling out from time to time: but the inconveniency may be in some measure obviated by supporting the limb with a proper bandage; by endeavouring to restore the tone of the relaxed parts by cold bathing; and, in some instances, electricity has appeared to prove useful.

We shall now proceed to speak of dislocations from external violence as they occur in particular parts.

## SECTION



## SECTION II.

*Of Luxations of the Bones of the Cranium.*

THE bones of the cranium are frequently separated from each other at the futures in cases of hydrocephalus internus. This, however, can seldom become an object of surgery. If the collection is removed either by the use of medicines or by an operation, all that art can do farther is to support the parts with a proper bandage.

We also find in some instances, that openings are produced at the futures by external violence, particularly by falls from great heights. Accidents of this kind, however, very commonly prove fatal. I have only met with one instance of a patient under such circumstances recovering.

covering. All that can with propriety be done, is to support the parts by gentle regular pressure with a proper bandage ; to prescribe blood-letting and other remedies, according to the violence of the symptoms ; and to keep the patient quiet and confined to a proper posture during the cure.

### SECTION III.

#### *Of Luxations of the Bones of the Nose.*

THE bones of the nose are so firmly united, and they serve so effectually to support each other, that they are seldom dislocated. Instances of it, however, are sometimes met with.

As these bones are only thinly covered with soft parts, luxations in any part of the nose are easily discovered by

by the touch, as well as by the deformity which they occasion.

In the reduction of a luxation of these bones, the patient should be seated opposite to a proper light, with an assistant behind supporting his head; and the surgeon standing before, should endeavour to replace the bones with as much exactness as possible. In general this will be practicable with the fingers alone; but when one of the bones is pushed inwards, it will be more easily accomplished by pushing one of the tubes in Plate XLIII. fig. 2. up the corresponding nostril, in order to elevate the depressed piece; and if the tube be guarded with some plies of soft lint, it may be retained in its situation till there is no longer any risk of the bone slipping out.

When either of the bones of the nose is pushed outwards, it must first be exactly replaced, and afterwards retained in its situation by a proper application of a double-headed roller.



## SECTION IV.

*Of Luxations of the Lower Jaw.*

THE lower jaw is connected by a piece of very beautiful mechanism with the bones of the head. There is in each temporal bone an irregular oblong cavity, immediately before the external meatus auditorius. In these cavities, the two condyles of the lower jaw are lodged; and by means of two intermediate loose cartilages which move along with the condyles, and which correspond with the irregular surfaces of the cavities in which they are placed, such a degree of firmness is given to this joint as would otherwise be inconsistent with the freedom of motion of which it is possessed; for although the condyles of the jaw are secured

cured by different ligaments, as well as by strong muscles, to their situations, particularly by the strong tendons of the temporal muscles inserted into the coronoid processes of the jaw; yet the variety of motions which the under jaw is constantly performing, would render it very liable to dislocations, were it not for the intervention of these moveable cartilages, which admit of every necessary freedom; while such a loose, extensive motion is prevented, as must have happened if the heads of the condyles had been placed in large smooth cavities without these cartilages between them.

The under jaw cannot be dislocated either upwards, backwards, or laterally; it can only be dislocated forward and downward. In every other direction, the condyles are so much surrounded with bone, that they cannot be forced out of their corresponding cavities, as will be readily seen on an examination of the skeleton: But when the mouth is widely opened, as happens in yawning, the con-

dyles are apt to slip too far over the anterior boundaries of these cavities. In this manner a dislocation takes place, as we discover by the chin being thrown forward and downward, while the mouth remains open, at the same time that much pain is produced by every attempt to close it; nor can the patient speak distinctly, or swallow but with much difficulty.

In some cases one side only of the jaw is dislocated, that is, one of the condyles remains nearly in its natural situation, while the other is thrown entirely out. In this case, the jaw, instead of falling directly down, is pushed downwards and somewhat towards the side opposite to that in which it is dislocated.

Besides the symptoms we have mentioned of pain on any attempt to close the mouth, and of difficulty in speaking and swallowing, we are told by all the ancient writers on this subject, and by all those who have copied from them, that luxations of the jaw are apt to induce convulsions, and even death. I have



have never, however, met with an instance of this, nor is it probable that it will ever happen, unless from great mismanagement on the part of the surgeon.

A luxation of the jaw being very distressing, and even alarming to those not acquainted with the real nature of it, immediate assistance is commonly desired; and with due attention we can seldom fail in reducing it.

The patient being firmly seated on a low chair, with his head properly supported behind, the surgeon standing before, with his thumbs sufficiently guarded, should push them as far as they will go between the teeth of the upper and under jaws, the under or flat part of the thumbs being applied to the teeth of the under jaw; the palm of each hand should be applied to the outside, while with his fingers he lays a firm hold of the angles of each jaw. With the fingers applied in this manner, he should pull the under jaw forward till he finds it move somewhat from its situation: and

this being done, but not till then, he should press the jaw forcibly down with his thumbs, and moderately backwards with the palms of his hands; when, if the different parts of the operation be rightly managed, the ends of the bone will immediately slip into their situation; upon which the thumbs should be instantly withdrawn.

In general, we are directed to press the jaw downwards and backwards: but although this might succeed in some instances where the jaw is dislocated only on one side, yet even there it would often fail; and it would seldom answer when both condyles are out: For till they be quite disengaged from the bones on which they rest, and which they can only be by pulling the jaw forward, all the force we can employ in pulling them down will be of little avail, as I have seen in different instances.

I have desired, in pressing down the jaw, that at the same time it should be pressed moderately backwards: The  
slightest

slightest force, however, in this direction will be sufficient: nay, in some cases it will not be found necessary; for as soon as the condyles are sufficiently depressed, they are almost instantaneously drawn into their natural situations by the ordinary action of the temporal muscles, whether any force be applied for this purpose or not.

The treatment we have advised answers equally well, whether the jaw be luxated on one side or on both; but where one condyle only is thrown out, the force used for depressing the jaw should be chiefly applied to that side.

A luxated jaw being reduced, the patient should be advised to avoid every cause that might have any effect in throwing the bone out again; particularly much speaking, gaping, and yawning, as the condyles are apt for a considerable time to be turned out by any of these.

In the reduction of a dislocated jaw, the thumbs are very apt to be bit if they



be not well protected, or if they be not instantly withdrawn on the bones slipping into their situations. For the most part the end of a handkerchief is wrapped round them ; but a covering of firm leather answers better, or a case of thin iron covered with leather, would be still preferable, as it would not occupy so much space. It would pass farther into the mouth, and would thus act with more advantage in forcing down the jaw.

## SECTION V.

### *Of Luxations of the Head.*

THE head is connected in such a manner with the atlas or first vertebra of the neck, that it moves upon it with ease and freedom backwards and forwards,

wards, the two condyles of the os occipitis being received into corresponding cavities in the superior oblique processes of that bone : But the lateral and rotatory motion of the head proceeds from the immediate connection between the head and second vertebra of the neck by means of the processus dentatus of that bone ; which passing through the back part of the large cavity of the atlas, is fixed by means of different ligaments to the os occipitis.

The connection between the head and the first of these bones is so firm that it is not probable they are ever separated ; at least I have not heard of any instance of this being discovered on dissection. It rather appears that in luxations of the head the connection is destroyed between the head and the second vertebra, the head being forced with such violence forward as to stretch or rupture the ligaments by which the tooth-like process of this bone is fixed to the occiput : at least this has been found to be the case  
in

in different instances of these dislocations; and it has been commonly observed in people who have suffered by hanging.

In every dislocation of the head, the head falls forward upon the breast; the patient is instantly deprived of sensibility; he lies as if he were dead; and soon dies if the luxation be not quickly reduced. Injuries of this kind are produced most frequently by falls from great heights or from horseback.

Luxations of the head for the most part terminate fatally; but as several instances have occurred where this has been prevented where timely assistance has been given, we have reason to suppose that recoveries from this accident would be more frequent if this could be always procured.

Different means have been proposed for the reduction of these luxations; but every thing requiring much preparation is here inadmissible. In all such cases, our views must be instantly carried into execution; and it fortunately happens,  
that



that in perhaps every instance they may be accomplished without any preparation.

The patient being seated upon the ground and supported by an assistant, the surgeon standing behind should raise the head from the breast; and the assistant being desired to press down the shoulders, the head should be gradually pulled straight up till the dislocation is reduced; or if this does not happen with moderate extension, it may at the same time be gently moved from side to side. A sudden crack or noise is heard on the reduction being completed; and if the patient be not entirely dead, it is immediately ascertained by a partial recovery of all his faculties. In some cases they have been completely restored on the head being replaced; but in others they have remained long impaired, and in some have always continued so.

The reduction being effected, the patient should be immediately laid in bed. His head should be kept elevated, and retained

tained by a proper bandage for a considerable time in one posture. And with a view to prevent inflammation, blood-letting should be prescribed in such quantities as the patient can easily bear; his bowels should be opened with proper laxatives; and he should be confined to a low regimen.

## SECTION VI.

*Of Luxations of the Spine, Os Sacrum, and Os Coccyx.*

THE vertebræ or bones of which the spine is composed, are so intimately connected by the processes of one bone running into corresponding parts of another, as well as by strong ligaments and muscles, that they are very seldom dislocated. They are so firmly united indeed,

deed, that I do not suppose that any of them can be dislocated by external violence without being fractured. Besides the means of connection we have mentioned, the vertebræ of the back are much strengthened by the support they receive from the ribs.

I never met with a complete dislocation of any of the vertebræ; nor do I suppose that it ever happens, even when accompanied with a fracture, without producing immediate death: for the force necessary to move one of the vertebræ, from its situation, would not only be attended with the compression, but even with the laceration, of the spinal marrow, while the contents of the thorax or abdomen would be essentially injured. I do not suppose, therefore, that a complete dislocation of any of these bones can ever become an object of surgery.

We know, however, that one or more of the vertebræ may be partially dislocated, and that the patient may survive for a considerable time. In some cases, perhaps, complete cures may be obtained;



ed ; but I believe these will not be frequent.

These luxations are usually produced by falls from great heights, or by violent blows, or by the passing of heavy weights over the body.

They are distinguished by the body being distorted, by examination with the fingers, and by the symptoms which they induce ; which are such as usually occur from compression of the spinal marrow ; particularly a paralysis of all that part of the body lying beneath the injured part, and either a total suppression of urine or an involuntary passing of both urine and feces.

There is reason to suppose, from the mechanism of the parts, that the vertebræ will seldom or never be dislocated outwards : They are usually forced directly forward, or in some degree to the right or left side. On this account it is extremely difficult to accomplish their reduction, as the contents of the thorax or abdomen must always lie between the  
injured

injured parts and the means used for this purpose.

Various means have been proposed, and different machines invented, for the reduction of dislocated vertebræ. These machines, however, should be laid aside, as being not only useless but dangerous: for whoever has paid attention to the anatomy of the spine, will see, that in dislocations of the vertebræ scarcely any advantage is to be gained from the application of much force, while a great deal of mischief may evidently ensue from it.

When one or more of the vertebræ are luxated forward, of which we can only judge by an accurate examination with the fingers, the most certain method perhaps of reducing the displaced bones is, to bend the body slowly and gradually forward, as far as it can be done, over a cask or any other cylindrical substance of a sufficient size. If the bone by this position regains its situation, the body should be immediately raised;

and the attempt should be repeated when it does not succeed at first.

When the displaced bone is pushed much out of its natural situation, neither this nor any other method will probably succeed; but it has certainly done so in different instances of partial dislocations. In bending the body forward, the two vertebræ lying contiguous to the one that is pushed forward are somewhat farther separated from each other; by which the displaced bone may, either by the compression produced upon the abdomen, or by the ordinary action of the contiguous muscles, be forced into the situation it formerly occupied.

When the dislocated bone, instead of being pushed straight forward, is forced in any degree to one side, the body, while the reduction of it is attempting, should not only be bent forward, but somewhat towards the affected side; by which means the two contiguous vertebræ will be separated to a greater distance than



they possibly could be by bending it either directly forward or towards the opposite side.

When any part of the os sacrum is luxated, all we can do is to replace it with as much exactness as possible by external pressure, and by bending the body forward in the manner we have mentioned.

The coccyx is more frequently luxated than any of these bones, as it is equally liable to the same kinds of injuries, besides being more exposed to the effects of falls, &c.

This bone may be luxated either outwardly or inwardly. It is apt to be forced outwards in laborious births, when much violence is used in pulling down the head of a child. And in some instances the same accident has occurred from large collections of hard feces in the rectum. We judge of this injury having occurred, from the pain which takes place all over the region of the loins, particularly about the junction of

the os coccyx with the sacrum ; and from the displaced bone being discovered upon examination with the fingers.

When the coccyx is luxated inwardly either by falls or blows, the patient complains of much pain, and a sensation of a tumor or some other hard body compressing the under part of the rectum ; he is liable to tenesmus ; he finds much difficulty in passing the feces ; and in some instances a suppression of urine takes place. On the finger being introduced at the anus, the displaced portion of bone is readily discovered.

In outward luxations of the coccyx, we seldom find much difficulty in replacing the bone by external pressure with the fingers ; but it is often difficult to retain it in its situation. It can only be done by supporting the parts with proper compresses and bandages. The T bandage answers for this purpose better than any other.

In the reduction of an internal dislocation of this bone, the fore-finger of  
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one hand, after being immersed in oil, should be passed as far as possible up the rectum. By means of it the bone should be pressed into its situation ; while with the other hand we support the parts which correspond with it externally.

As dislocations of these bones, particularly of the coccyx, are very apt to excite inflammation, and as this is apt to terminate in abscesses which do not readily heal, we should omit nothing that may probably tend to prevent it. Blood-letting should be prescribed in proportion to the strength of the patient, particularly local blood-letting by means of leeches, or cupping and scarifying ; a lax state of the bowels should be preserved ; and the patient should be confined to that posture in which he is easiest, and to a low regimen.



## SECTION VII.

*Of Luxations of the Clavicles.*

THE clavicles are joined externally to the scapulæ at the acromion, and their interior ends are supported by the upper part of the sternum.

As the clavicles are not possessed of much strength, and being tied at their articulations to the contiguous bones by ligaments, they are more exposed to fractures than to luxations. In some cases, however, they are luxated. This may happen at either extremity of these bones, but it is more frequent at their junction with the sternum than at the acromion: for the force by which luxations of the clavicles are produced is for the most part applied to the shoulders, by which their  
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opposite ends are most apt to be pushed out.

As the clavicles are thinly covered, luxations of either of their extremities are easily discovered: They are commonly attended with a considerable degree of stiffness and immobility in the corresponding joint of the shoulder, for the neck of the scapula having lost its support, it is apt to be drawn out of its situation; by which the motion of every muscle connected with the joint necessarily becomes affected.

A dislocation of the clavicle is easily reduced by moderate pressure with the fingers, especially if the arms and shoulders be at the same time drawn back; by which the space which the clavicle should occupy may be somewhat lengthened. It is more difficult, however, to retain the bone in its situation, as it is apt to be again displaced on the pressure being removed, by the ordinary action of the flexor muscles of the arm.

We derive little advantage here from

supporting the arm. On the contrary, when the end of the clavicle connected with the sternum is displaced, raising the arm does harm, as it tends to push the bone farther out of its place. It is, therefore, highly necessary to attend to this distinction in the management of fractures and luxations of this bone. In the latter, the raised posture of the arm does mischief: in the former, it is of service, as we have shown in Chapter XXXIX. Section VII.

It is necessary, however, that the weight of the fore-arm should be moderately supported, to prevent the shoulder from being too much drawn down. Besides this, the head and shoulders ought to be supported, and a moderate pressure made upon the displaced end of the bone. Various bandages have been proposed for this, particularly the long roller applied in such a manner as to form the figure of 8 upon the shoulders and upper part of the breast. No advantage, however, is gained from any bandage of  
this



this kind, as it cannot be retained so firmly in its situation as to produce any effect without impeding respiration. The machine represented in Plate LXXXVIII. fig. 1. nearly the same as is commonly used for supporting the head, answers the purpose better than any other: for while it necessarily raises the head and keeps back the shoulders, the straps which pass over the upper part of the breast may be made to act with some force upon the dislocated end of the bone. It is scarcely necessary to observe, that the use of this machine should be continued for a considerable time, otherwise the bone will be apt to start, when the whole will be to do over again.

## SECTION VIII.

*Of Luxations of the Ribs.*

**I**T has been generally supposed that the ribs cannot be dislocated; and accordingly this variety of luxation has passed unnoticed by different writers on this branch of surgery. It is only at the articulation of the ribs with the vertebræ that luxations can happen; and as they are connected with these bones by very strong ligaments, it is usually imagined that they will break before they yield at the joints.

It will readily appear, however, by an accurate examination of the junction of the ribs with the vertebræ, that they may be dislocated inwards. They cannot indeed be pushed either upwards,  
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downwards, or backwards; but we know from experience, that a strong force applied near to their articulations will rupture their connecting ligaments, and thus push them forward. The fact has been proved by dissection after death.

The symptoms induced by dislocations will be nearly the same with those which ensue from fractures of the ribs, viz. pain in the part affected, with difficult respiration; and if the end of the bone be pushed into the substance of the lungs, emphysematous swellings may ensue from it. A dislocation, however, may be distinguished from a fracture by the pain being most severe at the articulation, and by no part of the bone yielding to pressure excepting at this very spot.

I believe it will commonly happen, that the end of a luxated rib, in consequence of its elasticity, will return to its natural situation when the cause which produced the luxation is removed; but when it does not, the best method of reducing it will be to bend the body forward



ward over a cask or other cylindrical body, while the vertebræ immediately above and below the rib are pressed inward with as much force as can with safety be applied to them. After this, a thick compress of linen should be laid over the vertebræ we have mentioned, and another long one along the most prominent part of the dislocated rib and the two immediately contiguous; when, by means of a long broad roller passed two or three times round the body, such a degree of pressure may be made upon the vertebræ as will retain them in their situation; while the pressure made upon the projecting part of the rib tends to keep the end of it as steadily as possible in its situation till the ligaments that were ruptured be again united.

No bandage used for this purpose should be applied with such tightness as to give any impediment to the breathing. The best method of preventing the roller from moving is by the scapulary bandage passed over the shoulders, and

a strap connected with it behind carried between the thighs and fixed to it before.

No dislocation whatever is more apt to induce inflammation of the contiguous parts, and other disagreeable symptoms. For the prevention and removal of these, nothing proves so effectual as copious blood-letting, preserving the patient cool and at perfect rest, a low diet, and opiates if a cough ensues and becomes troublesome.

## SECTION IX.

*Of Dislocations of the Humerus at the Joint of the Shoulder.*

THE joint of the shoulder is formed by what is usually termed a Ball and Socket, the round head of the os humeri

meri being lodged in a superficial cavity on the anterior part of the scapula. This cavity is so superficial, that in the skeleton it does not appear to contain above a tenth part of the head of the humerus; but in the recent subject it is much more considerable, by means of a cartilaginous brim, the capsular ligament, which surrounds the whole joint. By this mechanism, the shoulder enjoys more free motion than other joints: but it is at the same time exposed to more frequent luxations; inasmuch, that there are more dislocations of the shoulder than of all the other joints of the body.

The os humeri is most frequently luxated downwards directly into the axilla, owing to the head of the bone meeting with less resistance in falling into this situation than in following any other direction. The head of the bone is sometimes pushed downwards and forward, and lodged beneath the pectoral muscle, when we find it resting on the

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ribs



ribs between the coracoid process of the scapula and the middle of the corresponding clavicle. In a few instances it is dislocated downwards and backwards: but it can never be luxated upwards without being accompanied with a fracture of the acromion; of the coracoid process; or perhaps of both.

The head of the bone, as we have already observed, for the most part takes that direction in which it meets with the least resistance; but this also depends in some degree on other causes, particularly on the part of the joint which received the injury, and on the situation of the humerus at the time. Thus, if a blow falls upon the upper part of the joint, while the arm is in a direct line with the body, any dislocation that takes place will be downwards; while the head of the bone will most probably be forced downward and inward by any stroke given to the outside of the joint while the elbow is stretched back, and vice versa.

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We judge that the humerus is displaced by the patient being unable to move the arm; by severe pain being excited on every attempt to press the arm near to the side; by the arm being of a different length from the other; from its being longer or shorter according as the head of the bone is lower or higher than its natural situation in the acetabulum scapulæ; by the head of the bone being felt either in the arm-pit beneath the pectoral muscle, or backwards below the ridge of the scapula; and by a vacancy being discovered beneath the acromion. If the two shoulders be examined together, which should always be done, the sound one will be found round and prominent, while the fore-part of the other, if much tumefaction has not taken place, will appear to be flat or even somewhat hollow.

In luxations of long duration, the whole arm is apt to become œdematous, and to be in some degree deprived of sensibility, from the pressure produced upon the  
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the nerves and lymphatic vessels of the arm by the head of the bone. All the other appearances we have mentioned, are likewise so obviously induced by the displacement of the head of the humerus, that scarcely any of them require to be explained. The head of the bone being thrown out of its natural situation, must necessarily affect the action of every muscle of the joint: Some will be too much relaxed, while others are too much stretched out: The motion of the joint must of course be considerably impaired. It is obvious too, that much pain must be excited by the arm being pressed down to the side, as the head of the bone will not only be forcibly rubbed against some part of the scapula, but the soft parts on which it rests must be greatly compressed, at the same time that some of the contiguous muscles will be stretched to a degree which they cannot easily bear.

In a simple dislocation of the humerus, our prognosis should in general be favourable; for in recent cases we seldom fail  
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in reducing the bone. It must be allowed, however, that instances sometimes occur, in which the utmost difficulty is experienced in effecting a reduction; but this is seldom the case where the treatment has been properly conducted from the first. In dislocations, indeed, of long continuance, the most expert practitioners often fail: for in such cases, the head of the bone has often formed a socket among the contiguous parts, from whence it cannot be dislodged without tearing asunder some of the muscles with which it is surrounded; and when dislodged, our endeavours may be rendered abortive by the cavity where the bone should be lodged being too much diminished for receiving it. In all cases, therefore, of long duration, although it may be proper to make some attempts to replace the dislocated bones, yet none that requires any great degree of force should be much persisted in, for there is always some uncertainty of their succeeding, while they necessarily produce

a great deal of pain, at the same time that they are apt to render the motion of the head of the bone in the artificial socket, which it generally forms for itself, more stiff than it was before.

In general it is supposed, that the reduction is more easily effected when the head of the bone is in the axilla than when it is pushed forward beneath the pectoral muscle; and that in this situation it is more readily done than when it is lodged backward beneath the spine of the scapula. The latter I believe to be so; but I have not found in the treatment of the others that there is any difference between them.

In the reduction of a dislocated humerus, we are in general told, that it is to be done by extension, counter extension, and the subsequent application of such a force as is sufficient to replace the bone. These three indications, however, may all be comprehended in one. If a sufficient degree of extension be applied for drawing the head of the bone on a line with the

acetabulum, the surgeon will seldom have any thing farther to do ; for when brought to this situation, the reduction will almost in every instance be completed by the ordinary action of the muscles.

All we have to do by counter extension, is to fix the body steadily while the arm is extending, and to prevent the scapula from being drawn forward by the force necessary for moving the arm ; for if this bone be not fixed, it in some degree moves forward with the humerus, by which the force employed for extending the arm is much lessened, at the same time that the cavity in the scapula in which the head of the bone is to be placed, is thus kept in a state of motion, by which the reduction cannot be so readily effected.

This being done, our powers of extension are applied to the arm, till the head of the bone be drawn on a line with the brim of the socket ; when, as we have observed above, it will instantaneously slip into its place by the action of the  
con-



contiguous muscles ; so that there is no necessity for the application of any force for this purpose. Much mischief has often been done by force applied with this view, as we shall presently see on considering the different modes of reducing luxations of this joint ; for it is obvious, if the force used for raising the humerus be applied before the end of it be drawn past the most projecting point of the scapula, that the two bones must be thus pressed together so as to obstruct the reduction.

Various modes have been proposed for the reduction of dislocated shoulders, in-  
somuch that we seldom meet with two  
practitioners who do it in the same man-  
ner: But as one or other of these must  
be preferable to the rest, and as it is of  
much importance to have this ascertain-  
ed, we shall offer a few observations upon  
each of them, and shall more particularly  
describe the one which we think should  
be adopted.

1. The humerus is often reduced by pref-

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sure with the heel upon the head of the displaced bone. The patient being placed upon the floor, the surgeon also sitting upon the floor, puts the heel of one foot, that of the left foot when he is operating upon the left shoulder, and vice versa, upon the head of the bone, and laying hold of the fore-arm with both hands, he extends the arm, at the same time that he endeavours with his heel to push up the bone.

When the head of the bone has fallen directly downward into the arm-pit, we are directed by some to place a small tennis ball or any other round substance between it and the heel; by which the pressure may be continued with more certainty into the bottom of the axilla than where the heel alone is employed.

This method, however, is liable to three very important objections. By laying hold of the fore-arm, the joint of the elbow is considerably stretched, by which it may be much hurt, while a great part of the force is lost upon it which  
ought

ought to have been applied entirely to the os humeri: By extending the fore-arm, several of the muscles of the arm itself, as well as the biceps flexor cubiti, are put upon the stretch; by which the extension is made with much more difficulty than when these muscles are relaxed by the joint of the elbow being properly bent. And, lastly, whether the heel be employed by itself or with a ball, it is much more apt to do harm than good; for if it be not applied with such nicety as to push the head of the bone directly towards the socket, it must necessarily force it against the neck of the scapula, or some others of the contiguous parts, and will thus tend in the most effectual manner to counteract the extension of the arm.

Besides, in this manner, the arm must in every instance be pulled in a very oblique direction downwards by the relative situation of the surgeon and patient; whereas it should in some cases be raised



nearly, though not altogether, to a right angle with the body, and kept in that position while the extension is making.

It may be alleged, indeed, that this method often succeeds, and that it has long been employed by some of our oldest and most experienced practitioners. This I admit: but I also know that it often fails, even with those who speak most favourably of it; and that other modes of treatment have in various instances completed the reduction, where this had previously proved unsuccessful.

2. Others attempt to reduce this dislocation, by endeavouring to force the head of the bone into the socket with a rolling-pin applied beneath it, while a sufficient force is employed for extending the arm, and for fixing the body in its situation. With a view to prevent the pin from hurting the skin, we are desired to cover it with flannel, and that part of it which passes into the axilla is directed to be more thickly covered than the rest.

But

But however this may in some instances have succeeded, it ought by no means to be received into practice. It is evidently liable to most of the objections we have mentioned to the mode of operating with the heel; particularly to the risk of forcing the head of the humerus in beneath the neck of the scapula, and thus counteracting the force employed for extending the arm. It is obvious, too, even on the principle upon which it is recommended by those who practise it, that this, as well as the mode of operating with the heel, cannot be applicable where the head of the bone is lodged either backward, or forward beneath the pectoral muscle: for the sole intention of both is to raise the head of the bone; and yet by some they are used indiscriminately, whether the bone be luxated downwards, backwards, or forward.

3. The patient being properly placed, the body fixed by assistants, and the arm extended in the manner we shall after-

wards direct, some surgeons make use of a towel or girth for pulling the head of the bone into the socket. The ends of the girth being tied together, one end of the double is put over the arm and carried near to the head of the humerus; and the other being passed over the neck of the operator, he forces up the end of the bone by raising his neck: and if this could be done with sufficient exactness, just when the head of the humerus has cleared the brim of the socket, no harm would arise from this part of the operation; but if the force for elevating the bone be applied before a sufficient degree of extension is made for this purpose, it must evidently do mischief by locking the head of the humerus and neck of the scapula together; so that this is in some measure liable to the same objections we have stated to the mode of operating with the heel and rolling-pin.

These were the means usually employed for reducing luxations of this joint; but



but being frequently found to fail, others have at different times been proposed in order to increase the powers of extension.

4. Of this nature is the Ambe of Hippocrates, as it is termed: It is the one that was chiefly employed by ancient practitioners, and in some parts of Europe it is still the only instrument used for this purpose: For this reason I have given a delineation of it in Plate LXXVI. fig. 1. but I do not by any means advise it to be employed. The powers of which it is possessed are great, but they cannot be properly applied; so that they are pernicious in proportion to their extent. It is liable in a tenfold degree to the objection we have stated above to the three preceding modes of reducing this bone, that of pressing the head of it against the neck of the scapula; by which one or other of them must frequently be broke, as must readily occur to whoever examines this instrument with attention;  
for

for instead of extending the arm before raising the end of it, the first action of this instrument is to raise the extremity of the bone, by which it must frequently be so firmly pushed in beneath the neck of the scapula, as to counteract with much effect the power that is afterwards applied for extending it.

5. The method of reducing this joint by means of a ladder has been long known, but we hope not often employed. The dislocated arm being hung over the upper step of the ladder, to which height the patient must be previously raised, and being secured in this situation by assistants, the seat on which he is placed is suddenly drawn away; by which the whole weight of the body falls upon the luxated joint, and by which we are told the bone may often be reduced when other means have failed. The top of a high door is sometimes used for the same purpose. Whether the door or ladder be employed, that part upon which the  
arm

arm is made to rest should be well covered with several plies of soft cloth.

6. The patient being laid upon the floor, the bone has in some instances been reduced by two or three stout men standing upon a table and lifting him up by the luxated arm.

7. Upon the same principle, it has been proposed to raise the patient by the luxated arm with ropes running over pulleys fixed in the ceiling of a high-roofed apartment. The jerk produced by the body being suddenly raised and let down, has in some cases succeeded where other attempts to reduce the humerus had failed.

This was first practised, I believe, by the ingenious Mr White of Manchester; and I have known it succeed in different cases of old luxations: But these methods are all liable to great objections. The force is too suddenly applied; by which more mischief may be done to the surrounding soft parts than can be compensated by the reduction of the bone.



bone. We know that muscles, blood-vessels, and ligaments, will stretch to a considerable degree, if the extending force be applied in a slow gradual manner: but we also know, that they very readily break when powerfully and suddenly stretched. Of this we have a remarkable instance in the bursting of the capsular ligaments of joints, which I believe to happen, as has been already remarked, in almost every case of luxation from external violence. This leads us to say, that any force that is used for the reduction of luxations should be applied in the most gradual manner, and that the mode of operating we are now considering must frequently do mischief by tearing and lacerating the soft parts surrounding the joint. Of this I have had various instances even where the teguments have been protected in the most cautious manner, by covering them with soft flannel, and afterwards with firm leather, before applying the ropes for extending the arm.

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Besides, in these modes of reduction, the arm must be always extended in the same direction, whether the bone be luxated forward, downward, or backward: Whereas the direction in which the arm is extended should vary according to these circumstances ; as must be obvious to whoever attends to the anatomy of the parts concerned in the luxation. Nay, in one variety of luxation, irreparable mischief may be done to the joint by extending the arm in a direction which, in another variety of the injury, might not only be proper but necessary. Where the head of the humerus is pushed forward beneath the pectoral muscle, or directly backward, we may readily suppose that it may be easily reduced by pulling the arm upward, as is done when the body is suspended by a pulley in the manner we have mentioned ; while much harm may be done by it where the head of the bone is lodged in the axilla, and pushed beneath the neck of the scapula. In this case, the  
end

end of the humerus is often so firmly wedged between the scapula and ribs, that one or other of these bones would necessarily break by the sudden application of much force in this direction ; and it can only be prevented by extending the arm somewhat obliquely downward till the head of the humerus be quite disengaged.

8. A machine has been invented for conjoining the power of the ambe with the mode of operating we have just been considering ; in which the patient's body is nearly suspended by the dislocated arm, and is suddenly raised and let down again while the operator endeavours with the lever of the ambe to elevate the head of the bone. The invention is ingenious, and the instrument is evidently powerful ; but if our objections to these two modes of operating, taken separately, are well founded, they are no less so when they are combined. The powerful action of the lever must be hazardous in proportion to the uncertainty of its application. While the body is quickly  
rising



rising and falling, the lever cannot possibly be applied with exactness to the end of the bone; and if it be made to act with much force before the head of the humerus is cleared of the scapula, one or other of these must necessarily be fractured.

9. When the more simple methods of reducing luxations have failed, ropes and pullies have sometimes been employed for dislodging the displaced bones. Of these different forms may be seen in Plate LXXVII. fig. 2. in Scultetus, Plate XXII. fig. 1. and in Plate X. fig. 7. of Desagulier's Experimental Philosophy. By means of one or other of these, any degree of force may be applied that can ever be required for this purpose.

10. But when recent cases are properly managed, luxations may in almost every instance be reduced without any assistance from machinery. I have often succeeded by the moderate extension I was able to make of the arm with one  
hand,

hand, while the other was employed in pressing back the scapula. This, however, requires all the muscles of the arm and fore-arm to be as much relaxed as possible; which we accomplish by bending the elbow moderately, raising the arm to a height somewhat less than a right angle with the body, and preserving it in such a direction as to prevent either the pectoral or extensor muscles of the arm from being stretched. When the arm is in this situation, we often find luxations easily reduced which had previously resisted the greatest force: for in this manner we not only relax the muscles of the arm, but the capsular ligament of the joint; by which the head of the bone returns more readily by the opening at which it was forced out than it otherwise possibly could do. For when the ligament is much stretched, the neck of the bone will be firmly grasped by it, by which our being able to return it will necessarily be rendered more uncertain.

More force, however, is sometimes required than can be applied in this manner; and the following is the method by which I have in every instance of recent luxations succeeded. The patient is seated upon a chair, and his body secured by a long broad belt passed round it, and given to assistants or tied round a post: a firm band of leather, four or five inches broad, and lined with flannel, as is represented in Plate LXXVII. fig. 3. is now to be tied round the arm immediately above the elbow. The three straps or cords connected with this band being given to assistants, they must be desired to extend the arm in the relaxed position we have mentioned, and in a slow equal manner, while another assistant standing behind is employed in pressing the scapula backward. The surgeon himself stands most conveniently on the outside of the arm: His business is to direct the assistants in the degree of force they are to employ, and to point out the direction in which the arm is to be extended;



he may also support the fore-arm and retain it bent at the elbow, in the manner we have mentioned. As soon as the head of the bone is drawn clearly past the brim of the socket, the extension of the arm should be somewhat relaxed, when the reduction will for the most part be accomplished by the action of the muscles of the joint; or it will be readily effected by moving the arm gently in different directions. A crack is heard on the bone slipping in; the patient finds immediate relief; and the anterior part of the shoulder acquires its usual prominent form.

The direction in which the arm is extended must depend upon the situation of the head of the bone; that in which it will meet with the least resistance is always to be preferred. When the head of the bone is pushed forward, and lodged beneath the pectoral muscle, the arm should be raised to a right angle with the body, and the same direction will answer where it is pushed backward: But  
in

in the most frequent kind of luxation of this joint, where the head of the bone is lodged in the arm-pit, the arm should uniformly be drawn somewhat obliquely downward: If extended when raised to a right angle with the body, it would be drawn against the neck of the scapula, by which much pain would be excited and the reduction frustrated. Of this I have seen many instances, as every practitioner must have done.

It should be a general rule in the treatment of every luxation to vary the direction in which the extension is made as soon as we meet with any considerable resistance; but in luxations of the humerus, attention to the observations we have just thrown out will for the most part prove sufficient.

In reducing luxations of this joint, it has been the prevailing practice to press the scapula forward and downward: Nearly the reverse of this, however, should be adopted. By pressing the scapula downward we force it against the

Q 2

head

of the humerus, the very thing we ought most carefully to avoid: and by forcing it forward, it is evident that the end of the humerus will not be so easily drawn out from beneath it as when the assistant is desired to pull it backward in the manner we have mentioned.

II. The mode of treatment I have just been describing will succeed in almost every instance of recent luxation; and it will seldom fail even in cases of long standing, where reduction of the dislocated bone is practicable: But when a greater force is required than can be applied in this manner, the instrument represented in Plate LXXVIII. may be employed. It was invented by the late Mr Freke of London; and it answers the purpose of extension better, and with more exactness, than any other I have seen. It is delineated exactly from the plate given of it by Mr Freke; but it admits of some improvements. The strap A A which passes over the shoulder presses down the scapula, and thus im-  
pedes



# PLATE. LXXVIII.

FIG. I.



FIG.

2.



FIG. 3.

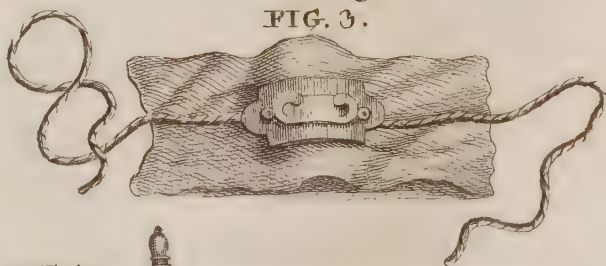


FIG. 5.

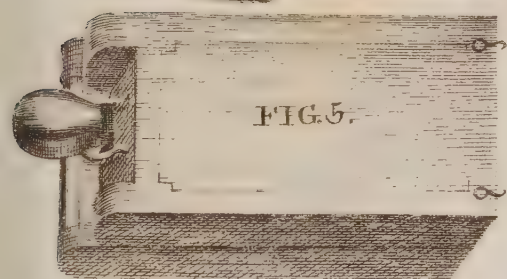
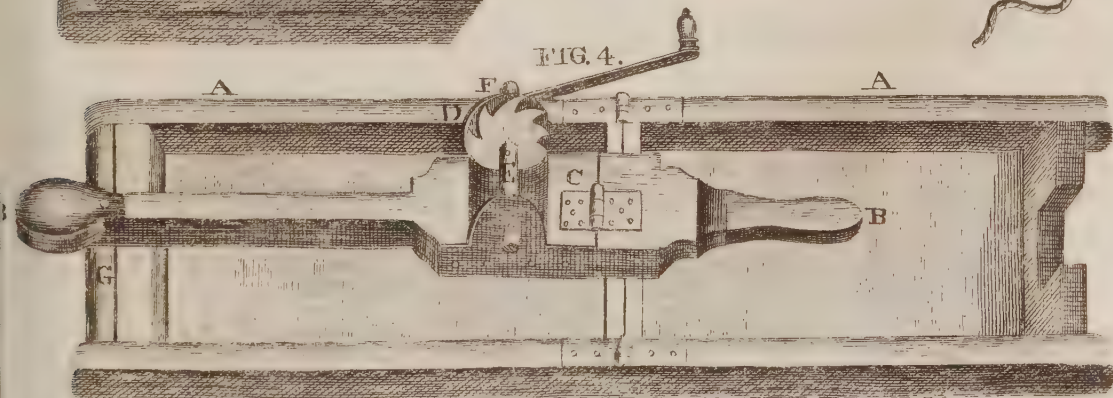


FIG. 4.





pedes the reduction of the bone: It should therefore be either entirely wanting, or made with a slit to pass over the arm so as to draw back the scapula: in which case, instead of passing obliquely downwards to be fixed in the floor, it should pass straight across, and be fixed in a post on a line with the shoulder.

We have already observed that the use of a lever in raising a luxated humerus is both unnecessary and dangerous: The lever of this instrument, therefore, instead of being moveable, should be fixed so as only to serve as a support to the arm; or if it ever be used as a lever, it should be managed with the utmost caution. The principal advantage derived from this instrument is our being able, by means of it, to apply any force that may be necessary in the most gradual manner; an object of the first importance in the reduction of luxations: It also extends the arm in any direction we may judge proper; by which it can at once



be adapted to any variety of such injuries.

Swelling, pain, and inflammation, when they occur as consequences of luxations of the arm, are to be removed by the remedies usually employed in such cases, but chiefly by local blood-letting by means of leeches.

The round head of the biceps flexor cubiti, which passes through the joint of the shoulder and is lodged in a groove in the head of the humerus, is apt to be separated from this bone when it is forced far out of its natural situation, and thus induces a stiff unwieldy state of the arm: for the most part it returns immediately to this groove on the dislocation being reduced; and we suspect that it continues to be displaced when any unusual pain, stiffness, or tension remain. The most certain method of replacing it is to move the arm from time to time in every variety of way; and we know that it is replaced, by an instantaneous removal of the distress.

The glenoid cavity of the scapula being

ing very superficial, the head of the humerus is apt to fall out again, even after it has been completely replaced; particularly when it has been frequently luxated. The most certain method of preventing this is to support the arm in a sling, as is represented in Plate LXXXI. fig. 2. till the parts recover their tone. Blisters applied to the shoulder, and pumping cold water over the joint, have also proved useful for this purpose.

## SECTION X.

*Of Luxations of the Fore-arm at the Joint of the Elbow.*

THE bones of the fore-arm at the elbow are more frequently dislocated upward and backward than in any other direction: They can scarcely be luxated laterally or forward, if the injury be not

at the same time accompanied with a fracture of the olecranon or top of the ulna, as will be readily perceived on examining the connection of that process with the cavity in the posterior part of the os humeri.

As the joint of the elbow is not deeply covered with soft parts, any luxation of the bones is easily discovered as long as swelling and tension have not taken place. When these symptoms occur to any extent, it is often difficult to distinguish either the nature or extent of the injury with which they are connected. When the luxation is backward, the olecranon is felt on the back part of the arm, and the condyles of the humerus are pushed forward. When the olecranon is broke and the ulna and radius pushed forward, they are also apt to be drawn upward on the anterior part of the humerus, when the condyles of that bone are discovered behind. The extent of the joint is so considerable from one side to the other, that the bones  
com-



composing it can never be completely luxated laterally, unless the soft parts with which they are covered are much lacerated. In whatever way they are displaced, the joint becomes immediately stiff and immoveable.

In the reduction of these dislocations the patient should be seated on a chair of a convenient height, and the arm firmly secured by an assistant: where the bones are luxated backward, the fore-arm should be moderately bent, in order to relax the flexor muscles: while in this position it should be slowly and gradually extended; and if care be taken to increase the curvature of the elbow in proportion as the extension is made, we will seldom or never fail in completing the reduction. Where the olecranon is broke, and the ends of the radius and ulna pushed forward and drawn up upon the humerus, we are under the necessity of extending the arm while in a straight position, as in this case the heads of these bones are pushed  
back

back upon the anterior part of the humerus on the least attempt to bend them. The extension should be continued till the ends of both bones are pulled somewhat lower than the most depending point of the humerus, when they will either regain their situation by the action of the muscles or be easily forced into it.

In lateral dislocations of these bones the extension must also be continued till they have clearly passed the end of the humerus, when by moderate lateral pressure they will for the most part be easily replaced. Of whatever kind the dislocation may be, the extension should be made by assistants grasping the arm immediately above the wrist; and while they are thus employed, much advantage may be gained by the surgeon pressing down the heads of the bones.

In two cases of dislocation of these bones, where their heads were drawn up upon the back of the humerus, the reduction was not accomplished, although

a great force was applied, not only in pulling at the under part of the arm, but in pushing down the heads of the displaced bones. In one of them, where the olecranon was pushed through the teguments, that part of the bone was sawn off, by which the reduction was effected: In the other, this expedient was not advised; and the practitioner finding all his efforts to reduce the bones prove abortive, the limb was amputated. As the extension in both was applied while the arm was stretched out, and as I have never failed in similar cases where the arm was bent, I conclude, that in the one the arm would have been saved, and in the other the joint preserved entire, if this practice had been adopted.

The reduction being completed, the fore-arm should be kept in that position which tends most effectually to relax all the muscles connected with it. The elbow being moderately bent, answers this purpose in the most certain manner.

These bones, when reduced, do not



readily fall out again ; but it is proper in this, as in every case of luxation, to preserve the limb as much at rest as possible till the injured parts have recovered their tone.

The bones of the fore-arm are also liable to be dislocated in their connection with each other. At the joint of the elbow a projecting part of the radius is lodged, and moves in a corresponding cavity of the ulna ; and below, a portion of the ulna is received by a similar cavity in the radius. Instances have occurred of these bones being separated from each other at both these points of connection ; but any separation of this kind is more apt to happen at the wrist than at the elbow. It is known to have occurred, by all the usual signs of luxations: By pain, swelling, and distortion in the injured part ; by the motion of the joint being impaired ; and by manual examination.

In general the displaced bone is easily put into its situation ; but for the most  
part

part we find it difficult to retain it. The most certain method of effecting this is, to put a long firm splint along the outside of the arm from the elbow down to the points of the fingers, and another of the same length on the inside; the whole to be secured with a flannel roller, and the arm hung in the sling represented in Plate LXXXI. fig. 2. By this the rotatory motion performed by the radius, and the pronation and supination of the hand, is prevented; and if this is guarded against for a sufficient length of time, a cure may at last be expected: While want of attention to this point is frequently the cause of the joint at the wrist remaining stiff for life, of which I have met with various instances.

## SECTION XI.

*Of Luxations of the Bones of the Wrist.*

THE bones of the wrist are not so frequently luxated as might be expected from the smallness of their size, owing to their being firmly connected by ligaments, as well as to the strength which they derive from the whole tending to form a kind of arch; the convex part of which being on the outer or back part of the hand, where it is most exposed to injuries, is particularly well calculated for preventing any of the bones from being displaced.

Degrees of force, however, are sometimes applied to them which they are unable to resist. From their form, it will appear that they will most readily be dislocated outward. The three superior carpal bones that form a kind of  
pro-



projecting head, that is lodged in a superficial cavity in the under extremities of the ulna and radius, may either be dislocated at this joint, or they may be separated from the five inferior bones of the wrist. In some instances one or more of these bones are separated from each other; and in others they are dislocated at their connection with the bones of the metacarpus and the superior bone of the thumb.

As these bones are not thickly covered with soft parts, the nature of the injury becomes immediately obvious when they are completely luxated: But in some cases, where perhaps a single bone is only partially displaced, if the parts be not examined with attention, the symptoms which occur are apt to be attributed to a sprain; and the real cause of them being overlooked, a permanent lameness is thus induced, which with much ease might have been prevented. Of this I have met with various instances. Similar occurrences, however, may always  
be

be prevented by an early and attentive examination of the injured parts.

In reducing luxations of these bones, we are in general desired to stretch the arm and hand upon a table, and while they are in this position to push them into their situations: But it is better to have the arm and hand supported by two assistants, as in this situation the surgeon gets ready access to each side of the wrist. The assistants should be desired to keep the parts sufficiently firm, but not to stretch them; and when in this situation, the surgeon will seldom find it difficult to push the bones into their places. They must be retained by splints and bandages in the manner mentioned in the last section; and as dislocations of these bones are very apt to induce inflammation of the ligaments and other contiguous soft parts, repeated applications of leeches should be advised as the most certain preventative.

## SECTION XII.

*Of Luxations of the Bones of the Metacarpus  
and Fingers.*

WE have seen in the last section that the metacarpal bones may be dislocated at their junction with the bones of the wrist; and they are sometimes displaced at their under extremities, where they are connected with the bones of the fingers. They are not so frequently luxated, however, as at first view might be expected; probably from the joint of the wrist being so moveable, that the whole hand readily yields to any force that is applied to it.

The bones of the fingers and thumb are also sometimes luxated; but we likewise consider the mobility of these bones as the principal reason of their being less frequently dislocated than many of the



largest and strongest bones that are much more firmly connected together.

Dislocations of these bones are easily discovered by the usual symptoms which take place in luxations; but particularly by the deformity which they produce, which in this situation is always conspicuous.

When any of the metacarpal bones are displaced at their connection with the bones of the wrist, the best method of reducing them is, by keeping the arm steadily fixed, and pushing them from above downward, while the hand remains loose and moveable. When the first phalanx of any of the fingers is moved from its junction with the corresponding metacarpal bone, it is to be replaced by one assistant fixing the hand, while another draws down the dislocated finger, which should be done by grasping the first phalanx only, in order to prevent the other joints of the finger from being hurt. Dislocations of all the other joints of the

4

fingers,

fingers, as well as of the thumbs, are to be managed in the same manner.

In the reduction of these dislocations, the bone should not be pulled down till it be somewhat raised or elevated from the contiguous bone; for as all the bones of the fingers and thumbs, as well as those of the metacarpus, are considerably thicker at their extremities than in any other part, these projections are apt to be forced against each other when the extension is made in a straight direction. In this manner the greatest force has frequently been employed in vain; nay, fingers have been amputated where this cause alone prevented luxations from being reduced, and in which a very inconsiderable force would have proved successful, if the displaced bone had been somewhat separated from the other before any force was applied for extending it.

## SECTION XIII.

*Of Luxations of the Femur at the Hip-Joint.*

THE socket or acetabulum formed by the ossa innominata for lodging the head of the thigh-bone is so deep; the brim of the socket in a recent subject contracts so much as even to grasp the neck of this bone; the head of the bone is so firmly tied down to the bottom of the socket by a strong ligament; and it is so confined by strong muscles, that we would not *à priori* suppose that it could be luxated by external violence: We would rather imagine that it would break at the neck where it is weakest, than that the head of it should ever be forced from its socket: This opinion has accordingly been adopted by many in all ages. For a considerable time I was disposed to favour it, from having observed  
several



several cases which at first were supposed to be luxations, but which proved to be fractures of the neck of the femur. In the course of the last few years, however, I have seen several cases in which I was convinced that the thigh-bone was luxated. The nature of the symptoms gave reason to imagine that they arose from luxations; and they were proved to do so by the patients being instantaneously and completely relieved on the head of the bone being replaced.

In treating of fractures of the thigh-bone, we mentioned the circumstances by which fractures of the neck of it may most readily be distinguished from luxations: We must therefore refer for this part of our subject to the eleventh Section of the preceding Chapter.

It is said by authors, that the head of the femur may be luxated in various directions, namely, upward and backward, upward and forward, downward and backward, downward and forward, and I may add directly downward. That all

of these may happen, I cannot take upon me to deny; but I believe few practitioners have met with an instance of the first and third. The second variety, where the head of the bone passes up upon the os pubis, may happen; as may likewise the last, where it is forced directly down: but I have never seen any variety except that in which the head of the femur is pushed downward and forward, and lodged in the foramen ovale. All practitioners admit, that the bone is most frequently dislocated in this direction; and an examination of the skeleton, as well as of the recent subject, will show why it should be so. The brim of the socket over all the upper and back part of it, is not only stronger, but more elevated than in the rest of it. It falls away as it descends; and on the anterior under part of it there is a considerable vacancy in the bone, the space being filled with a ligament only: and as this opening is sufficiently large to admit the head of  
the

the femur, we are led to imagine that luxations will be most apt to occur here.

Every luxation of the femur must be productive of lameness, and of pain, tension, and other symptoms with which luxations in general are accompanied. When the head of the bone passes upward and backward, the leg will be considerably shorter than the other; inso-much that the points of the toes will only touch the ground when the patient is standing upon the other foot; the great trochanter of the thigh-bone will be much higher than in the other side; the knee and foot will be turned inward; and a good deal of pain will be induced by every attempt to turn them out.

When the femur is luxated upward and forward, the leg will be shortened; the head of the bone will be felt resting upon the os pubis in the groin; the great trochanter will be on the upper and anterior part of the thigh near the groin, while a vacancy will be discovered in that part of the hip which it ought to

R 4

occupy;



occupy; the knee and toes will be turned outwards; and if the dislocation be not soon reduced, pain, tension, and inflammation, will probably occur in the spermatic cord and testis from the pressure made upon the cord by the head of the bone.

If ever this bone be luxated downward and backward, the leg will be considerably longer than the other; the knee and toes will be turned inward; and the great trochanter will be much lower than the same protuberance of the other limb. When the head of the bone passes directly downward, the leg will also be longer than the other, and the trochanter will likewise be lower; but the knee and toes will retain nearly their natural situation, only every attempt to move them will be productive of pain.

In the most frequent luxation of the femur, the leg appears to be considerably longer than the other; the knee and points of the toes are turned outward, nor can they be moved either farther  
outward

outward or inward but with much pain; all the muscles in the internal part of the thigh are tense and painful; the femur cannot be felt on the outside farther up than the middle of the thigh; a vacancy is discovered in the usual seat of the great trochanter, which is found farther down and on the anterior part of the thigh, while the head of the femur is plainly felt a little below the groin, being seated, as we have observed above, in the foramen ovale.

In all luxations of the femur, the difficulty and uncertainty of reducing them has been considered as so great, that in general we have been advised to give a very doubtful prognosis of the event. In cases of long duration this should always be done: for besides other causes which add to the difficulty of reduction, the muscles here are so strong that they resist, in the most powerful manner, every attempt to dislodge the head of the bone after it has been long fixed among them;  
by

by contracting round the neck of the bone, they must even be tore asunder before it can be reduced : But in recent luxations we have not this difficulty to encounter ; and we know that with proper management the bone may in almost every instance be reduced.

The reduction of this bone is always attempted by pulling the limb downward ; and it seems to be an opinion very universally received, that any force we employ should be applied in this direction. Some advise the limb to be drawn directly down from the part in which the head of the bone is lodged ; others desire it to be pulled exactly in a line with the hip-joint, while others turn the knee somewhat inward. The patient being placed upon his back and properly secured, the limb is extended in one or other of these directions, either till the reduction is accomplished, or till such a force is applied as makes the operator afraid of doing harm were he to proceed farther.

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PLATE LXXIX.

FIG. I.

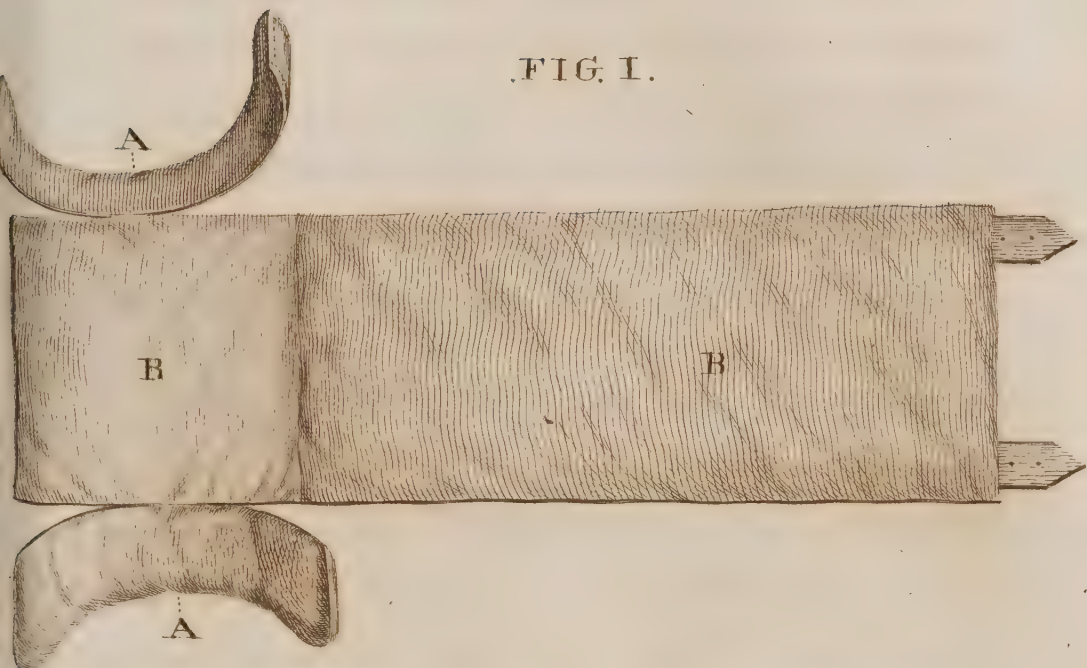


FIG. 2.

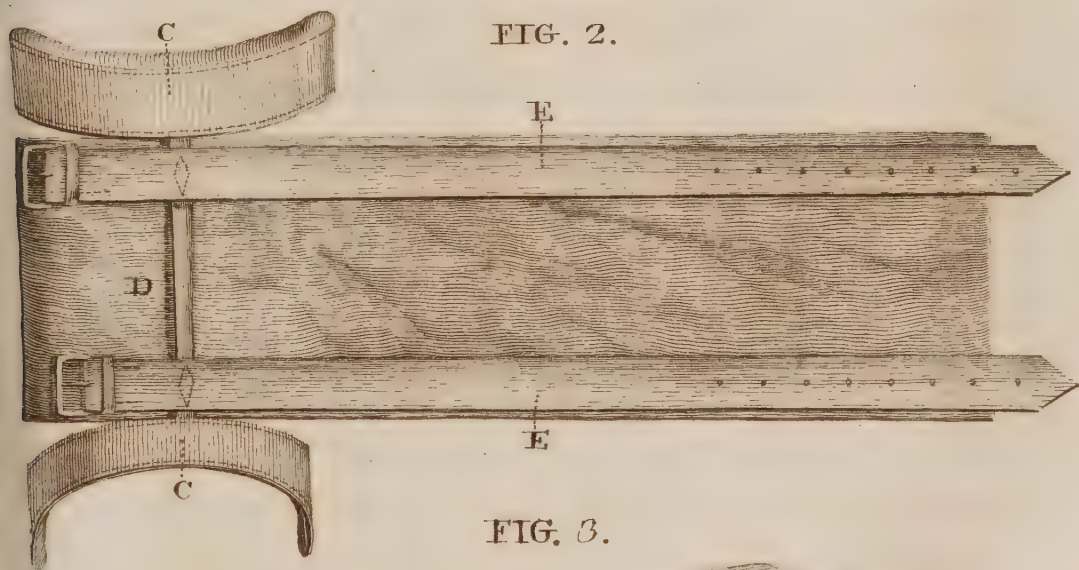
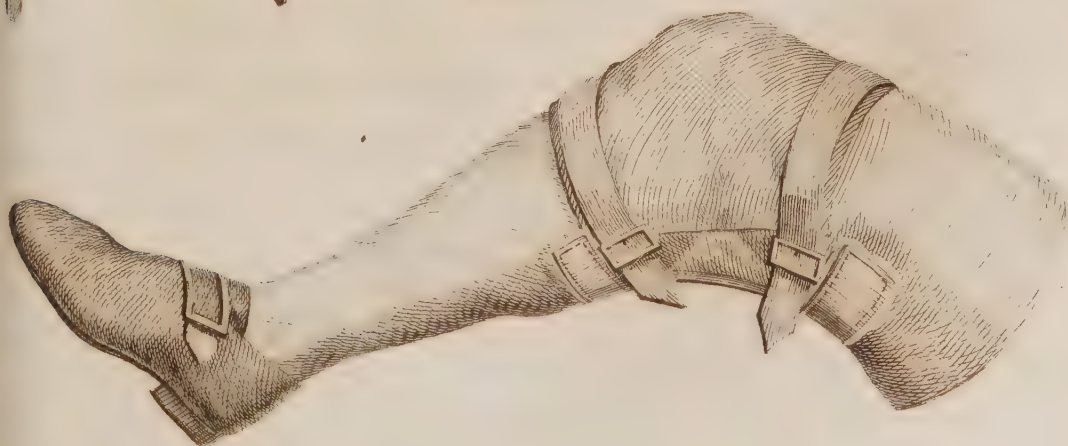


FIG. 3.





It must be allowed that dislocations of the femur have in various instances been reduced in this manner: it might often succeed where the head of the bone is forced upwards; but I may without hesitation assert, that even in this case the reduction might be effected with less force in a different manner; and in a great proportion of cases where the head of the bone is lodged in the foramen ovale, or where it is forced directly downwards, that we must necessarily fail entirely by confining the line of extension to any of the directions we have mentioned.

In whatever way the head of the femur is luxated, it must pass over some inequalities or prominent parts of the contiguous bones: These it must again pass over before it be reduced: At least this must be the case if we wish it to return by the same route; and it will be admitted in the treatment of luxations to be a good general rule, to endeavour to replace the bone by the opening at  
which



which it passed out. But where the limb is only pulled downward in the usual way, the head of the bone will be forced against the projecting brim of the socket if the dislocation is upward: or it will be drawn to a still greater distance from the joint where the bone is dislocated either directly downward, or lodged in the foramen ovale in the upper and inner part of the thigh. Wherever the head of the bone may be lodged, it should be completely raised above any projecting part of the contiguous bones before any other attempt is made for reducing it. As this will remove the principal impediment to the reduction, if the muscles of the limb be at the same time relaxed it will easily be drawn into the socket when the dislocation is upward, or pushed into it where the head of the bone is already beneath it.

In the most frequent variety of this luxation, where the head of the bone is pushed downward and forward, I have succeeded in the following manner:

The

FIG. I.

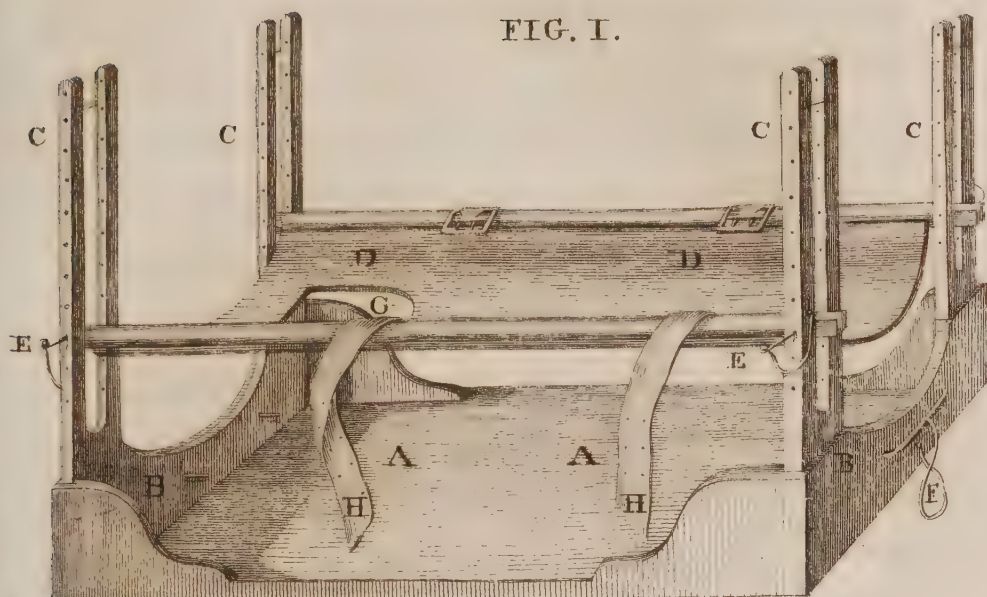
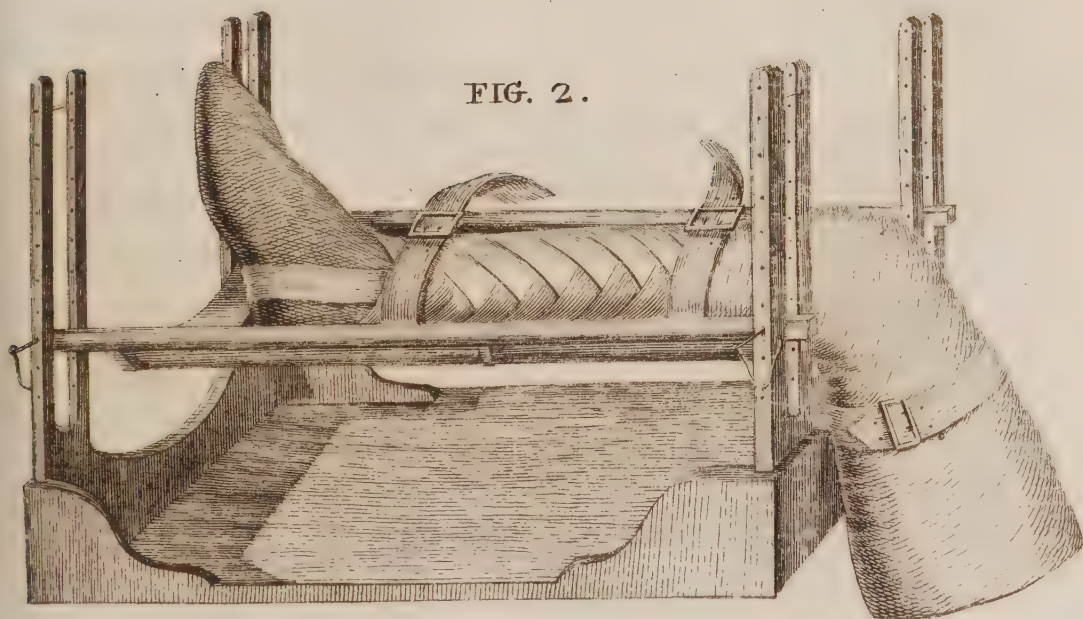


FIG. 2.







The patient is laid upon his back across a bed, and firmly secured by an assistant or two: A broad strap, or table-cloth properly folded, is passed between his thighs and over the groin on the sound side, and given to two other assistants: A similar strap is passed round the luxated thigh as near as possible to the head of it; the ends of which must be given to an assistant standing on the opposite side: The belt represented in Plate LXXVII. fig. 3. being previously fixed upon the under part of the thigh, the straps connected with it are given to an assistant or two, while the knee is supported by another assistant with the leg moderately bent. The thigh is now to be moderately stretched by the assistants who have the charge of the straps at the under part of it; but the extension should not be carried farther than what may be considered as necessary for drawing the head of the bone down to the under part of the foramen ovale; and this we may always effect with a very

moderate force. The strap round the root of the thigh must now be firmly pulled by those who have the charge of it; who, standing somewhat higher than the patient, should draw the thigh upward and inward; and the extension should be continued in this direction till there is reason to suppose that the head of the bone is clearly raised from the foramen in which it was lodged. At this time the person who has the charge of the knee should be desired to move it somewhat inward, and to push the thigh upward and obliquely outward: he will do this with the greatest certainty of succeeding if he secures the knee with one hand and the foot with the other, at the same time that he takes care to keep the leg just so much bent as may relax all the flexor muscles without stretching the extensors. If the different assistants perform their parts properly, the first attempt will prove successful; but if any of them have failed, particularly if the head of the bone has not  
been

been sufficiently raised from the hollow in the foramen ovale before being pushed upwards, the attempt must be repeated.

As the head of the bone may for the most part be felt outwardly, the surgeon may in general ascertain with certainty whether it be sufficiently raised or not. If he finds it rise easily, the force may be continued till it appears to be about an inch higher than when it was first applied: while on the contrary, if it yields with difficulty, there will be reason to suspect that some part of the head of the bone is fixed or locked in the upper part of the foramen ovale; in which case the force in this direction should be discontinued, and the other assistants at the knee being directed to increase the extension downward, it will afterwards be more easily raised.

In whatever direction the bone may be dislocated, this is the point requiring most of our attention, to raise the head of the bone sufficiently before any attempt is made to force it into the socket.

When



when this is effected, a very slight force will in general draw it down when the dislocation is upward; and when dislocated downward, whether it be somewhat backward or directly on a line with the socket, it will be easily pushed up.

In this manner recent luxations of this joint may for the most part be reduced; and the same treatment is perhaps the best even in luxations of long duration. In these it will sometimes fail; but it will succeed, I believe, as frequently as any other that has yet been proposed, while it is not productive of the dreadful pain which commonly ensues from the use of some of those machines that have been invented for making a greater extension of the limb. When any additional force, however, is judged to be necessary, it may either be obtained by a proper application of Mr Freke's machine represented in Plate LXXVIII. of Mr Petit's in Plate LXXVI. fig. 2. or of the pullies and ropes represented in Plate LXXVII.

It

It should be remarked, however, that no assistance of this kind can ever be applicable where the luxation is downward. Extension of the limb having been considered as necessary in every variety of luxation, it has often been indiscriminately employed, whether the head of the bone was placed above or below the socket: It is obvious, however, that it is in the former only that it can ever prove useful; and in the latter, that much mischief may ensue from it.

The violent distention of the muscles and extensive laceration of the articular ligaments, with which luxations of this bone must be always accompanied, render much care and attention necessary long after the reduction is accomplished. Local blood-letting with leeches, or cupping and scarifying, proves particularly useful here, and should be repeated more or less frequently according to the violence of the symptoms and age and habit of the patient; and till the parts may be supposed to have recovered

their tone, the patient should be kept as much at rest as possible.

By many it is imagined that the femur may be partially luxated; and the appearances which are supposed to arise from what is termed a Subluxation of this bone are described by authors: Of these, however, I have taken no notice, as it is not my opinion that this bone can be partially luxated. The head of it is so round, and the brim of the socket so narrow, that whoever examines them with accuracy will be convinced that it cannot happen. The head of the bone may in a gradual manner be pushed out of the acetabulum by a tumor at the bottom of it, but I do not suppose that this can ever occur from external violence.

S E C-



## SECTION XIV.

*Of Luxations of the Patella.*

THE patella may be either partially or completely luxated, and it may be displaced either upward or downward, outward or inward: It may also be luxated by itself, or it may be displaced along with the tibia and fibula in luxations of these bones. It cannot, however, be completely luxated in any direction if it be not accompanied with a rupture of the ligament which ties it to the tibia, or of the tendon of the rectus muscle connected to the upper part of it; or perhaps of both: and it will be more readily dislocated inwardly than in any other direction, owing to the internal condyle of the femur being somewhat less prominent than the other:

for as this bone is placed in some degree between these condyles, it will necessarily be most easily forced out at that side where it meets with the least resistance.

Luxations of this bone are for the most part easily discovered, as it is thinly covered with soft parts : But when it has been long displaced, it is apt to induce so much tumefaction, not only about the joint, but over all the contiguous parts, as to be distinguished with difficulty. Even the most partial luxation of the patella always gives considerable lameness and much pain on every attempt to move the joint.

In the reduction of a luxated patella, the patient should be placed either on a bed or on a table, and his leg should be stretched out and kept in this posture by an assistant. The surgeon should now lay hold of the bone and endeavour to push it into its situation ; but instead of pushing it directly forward, it should first be somewhat raised, otherwise we  
will

will be apt to force it against the condyles of the femur or head of the tibia. The best method of effecting this is to press down the side of the bone most distant from the joint; by which the opposite side of it will be elevated, when a very moderate force will press it into its place. When the patella is drawn out of its situation by the tibia and fibula being displaced along with it, it cannot be replaced till the reduction of these bones is accomplished.

## SECTION XV.

*Of Luxations of the Tibia and Fibula at the Joint  
of the Knee.*

THE tibia is the only bone of the leg that is immediately concerned in the joint of the knee; but as this bone cannot be dislocated without drawing the fibula along with it, we think it right to mention them together.



As more strength is required in the knee than in any other joint of the body, the bones of which it is chiefly formed, the femur and tibia, are connected together by the strongest kind of articulation, namely by *Ginglimus* or the Hinge-like joint: the surfaces of the two bones are very extensive, and they are firmly tied together by strong ligaments: There is also reason to suppose that the moveable cartilages placed between the ends of these bones have some influence in lessening the friction of the joint, and in thus rendering it more firm than it otherwise would be.

The great strength of this joint is the reason of its being less frequently dislocated than any other in the body: It cannot indeed be completely dislocated but by the application of so much force as will not only rupture the teguments which cover it, but the strong ligaments and tendons which tie the bones together. As this requires a very unusual degree of violence, these bones are seldom

dom forced entirely past each other; and the same reason even prevents them from being often partially luxated. When either a complete luxation, however, or a partial one, is produced, it may happen nearly with equal ease on either side; but the bones will be more readily forced backward than forward, owing to the flexor muscles and tendons of the leg being much stronger than the extensors.

The most partial luxation of this joint is readily distinguished, not only by the violent pain which it excites, and the lameness with which it is attended, but by the deformity which it produces, and which is always obvious on comparing both knee-joints together.

When the patella is dislocated at the same time with the tibia and fibula, it will for the most part be reduced along with these bones; but when this does not happen, it may be afterwards replaced in the manner we have mentioned in the last Section.

Luxations of this joint are to be re-

duced by fixing the thigh with sufficient firmness, and extending the leg till the ends of the bones are entirely clear of each other; when the tibia and fibula connected with it will be easily replaced. In partial luxations, the degree of extension necessary for this will be inconsiderable; but where the bones are completely displaced more force will be required. It is scarcely necessary to observe, that the muscles of the leg should be as much relaxed as possible while the force for extending it is applying.

Scarcely any joint is so apt to suffer from inflammation as that of the knee: so that in all such injuries as this, where the surrounding soft parts are so liable to inflame and become painful, the most strict antiphlogistic course becomes requisite; local blood-letting should be prescribed, and repeated according to the violence of the symptoms and strength of the patient; and the limb should for a considerable time be kept at perfect rest.

The



The upper end of the fibula, as well as the under extremity of it, is sometimes separated by external violence from the tibia. As the symptoms which this excites are similar to those which occur from sprains of the muscles, the real nature of the injury is often overlooked. It may almost always, however, be distinguished by an attentive manual examination. The only method of obtaining relief is by replacing the bone, which for the most part is easily done, and retaining it with a proper bandage till the parts have recovered their tone.

## SECTION XVI.

*Of Luxations of the Foot at the Joint of the Ankle.*

**T**HE joint of the ankle is formed by the upper part of the astragalus or first bone of the foot, being received into a cavity in the under extremity of the tibia; which is bounded externally by the end of the fibula, projecting a considerable way past the end of the tibia.

The astragalus may be dislocated either backward or forward, outward or inward, but it is more frequently pushed inward than in any other direction. The great strength of the tendo achillis prevents it from slipping easily backward, and it has also some effect in preventing it from going forward. It cannot be  
pushed

pushed outward without breaking the projecting end of the fibula.

Dislocations of this joint are in general easily discovered by the pain and lameness which they produce, as well as by the obvious alteration which they occasion in the appearance of the foot. When the astragalus is pushed forward, the foot appears to be lengthened and the heel shortened; when pushed backward, the foot is shortened and the heel lengthened; and when luxated either outwardly or inwardly, there is always a preternatural vacancy on one side of the joint and a prominency on the other.

In the reduction of this luxation, the patient should be placed either upon a table or on a bed, and the leg with the knee bent should be firmly secured by an assistant or two. The foot is now to be put into that situation which tends most effectually to relax all the muscles which belong to it; and being given to an assistant, he must be desired to extend it in that direction till the most prominent  
3 point

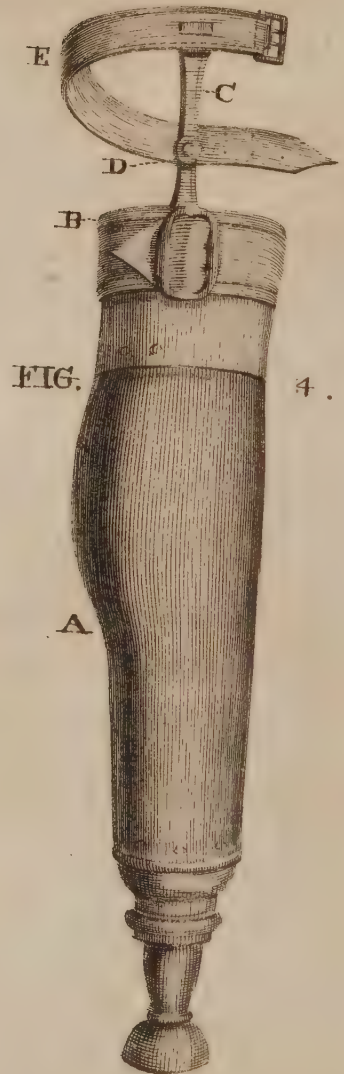
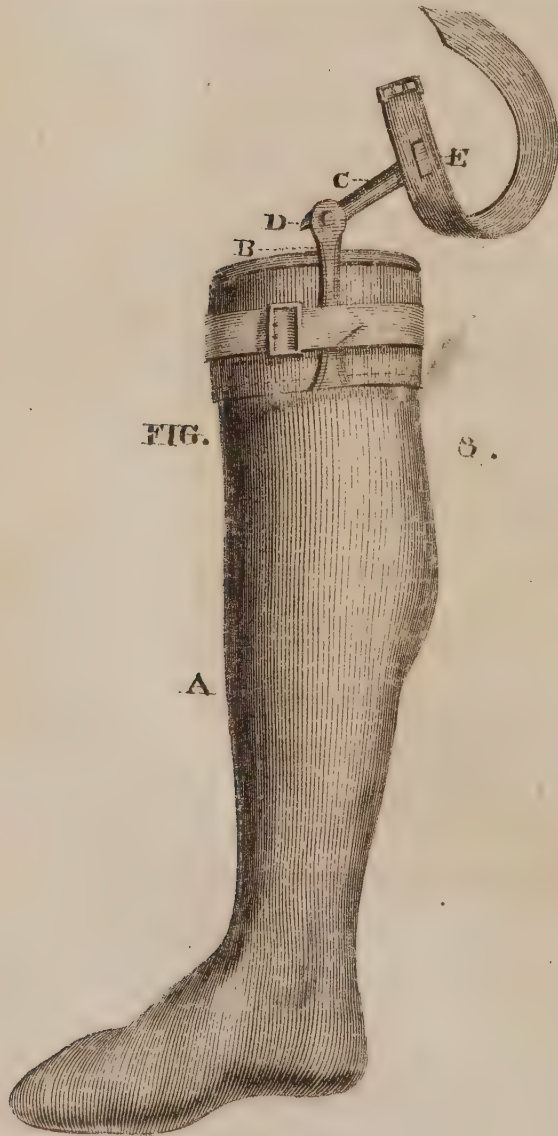
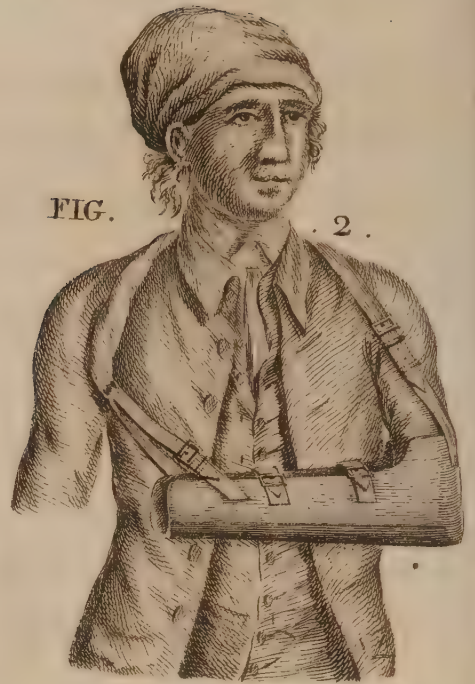
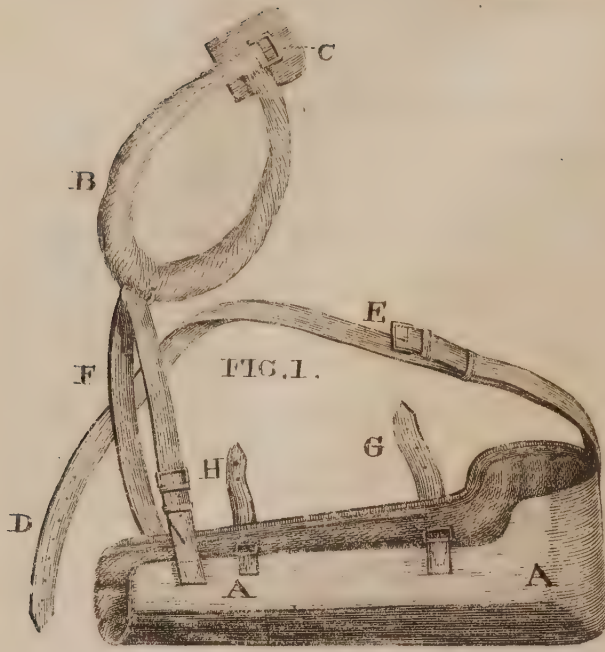


point of the astragalus has clearly passed the end of the tibia, when the bone will either slip into its place, or may be easily forced into it.

As the upper part of the astragalus is not perfectly round, but rather somewhat hollow, this joint is more apt to be partially luxated than any other formed by a ball and socket, as this in some measure is: Partial luxations of it, however, are easily reduced.

Besides the usual antiphlogistic course which we have recommended to be observed after all luxations of the large joints, it is particularly necessary in luxations of the ankle to keep the limb for a considerable time at the most perfect rest, especially where the under extremity of the fibula is broke by the foot being forced outward; for as the stability of the joint depends in a great measure on this bone, if it be not either rightly replaced or retained in its situation till the cure of the fracture be effected, it may afterwards continue weak during  
life,







life, or be attended with stiffness and pain to a great height. Any weakness which succeeds to injuries of this kind, if it be not removed by these measures, will be most effectually obviated by a firm splint of thin iron connected with the shoe, and applied along the outside of the leg; or by an instrument invented by the late Mr Gooch, represented in Plate LXXXIII. fig. 4.

## SECTION XVII.

*Of Luxations of the Os Calcis and other Bones of the Foot.*

THE os calcis, which is the largest bone of the foot, is sometimes dislocated laterally, where it is connected with the astragalus. It is prevented from being pushed forward by the other bones of the foot; and the tendo achillis,

2 which

which is inserted into a large rough process of this bone, which projects backward and forms the heel, prevents it from being luxated in this direction.

The astragalus and os calcis are sometimes luxated at their junction with the os naviculare and os cuboides; and as this joint, if it may be so termed, is at no great distance from the ankle, this variety of luxation has, in some instances, been mistaken for luxations of that joint. The foot may at this part be pushed either outward or inward, or it may be forced directly downward: It will rarely be luxated upward, as it can scarcely be exposed to external violence in such a direction as could have this effect.

Luxations of any of these bones are readily discovered by the pain and lameness with which they are always attended; as well as by the alteration which they produce on the shape of the foot.

The os calcis, when displaced, is more difficult to reduce than almost any other bone of the foot: It can only be done  
by

by fixing the leg and foot in such a position as tends most effectually to relax the different muscles which belong to them; and while they are in this position, by endeavouring to force the bone into its situation: and this will be more readily effected, if during the operation the foot be moderately extended.

In luxations of the astragalus and os calcis with the os naviculare and os cuboides, as the anterior part of the foot is apt to be drawn towards the heel, it becomes necessary to extend it to such a degree as may clear the bones on the opposite sides of the joint of each other; for till this be done, the reduction cannot be effected, while the bones will immediately slip into their situation as soon as they are drawn past each other.

The other three bones of the tarsus, usually termed the Cuneiform Bones, as well as the Metatarsal Bones, and the Bones of the Toes, are all liable to be luxated, and they may be displaced almost in every direction. But it is not  
necessary



necessary to speak of the method of reducing them; for the observations we had occasion to make on dislocations of the bones of the hand are equally applicable here: so that we shall now refer to what was said on that subject in the XIIth Section of this Chapter.

CHAP.

## C H A P. XLI.

*Of DISTORTED LIMBS.*

**L**IMBS may be distorted in various ways and by different causes; either from a morbid state of the bones, or from a contracted state of the muscles, or the bones and muscles may both be affected. In some cases the distortion is owing to an original mal-conformation; in others it occurs in infancy, and in some at more advanced periods of life.

For a considerable time after birth the bones are soft and pliable, and are easily affected by the postures of the body. The bones of the legs are apt to be crooked by children being made to walk too ear-

ly. It is also the effect of some diseases, particularly of rickets, to soften the bones so much that they easily yield to the posture of the body, as well as to the ordinary action of the muscles. But the most frequent cause of distorted limbs is that contraction of the flexor muscles of the leg and fore-arm, which is often induced by an inflamed state of the knee and elbow, and of which we have a very common example in those cases of white swelling to which these joints are more particularly liable. As the limb lies easiest while the muscles are relaxed, the patient naturally keeps it always bent; and when this posture is long continued, it almost constantly terminates in such a rigid contracted state of the flexor tendons, as keeps the under part of the limb at an angle with the superior part of it: Of this we meet with daily instances in the leg; where from this cause alone a patient is often altogether deprived of the use of his limb.

As



As it has been a very prevailing opinion among practitioners, that little or no advantage can be obtained from any remedies that we may employ for distorted limbs, they have seldom made any attempt to cure them. In consequence of which this branch of practice has been almost universally trusted to itinerants or to professed bone-setters. In this, however, we are wrong; and in saying so, I can speak with confidence from much experience in cases of this kind: Having early in life observed the misery to which patients with distorted limbs were reduced, I was resolved to make some attempts for the relief of such as might apply to me, however small the chance might be of succeeding; and in various instances I have had the satisfaction of relieving, and in some cases of curing completely, patients who had been lame for several years, and where it was not expected that any thing could be done for their advantage. Where an anchylosis is formed by the ends of two

T 2

bones

bones forming a joint having adhered together, it would be in vain to make any attempt to remove it, unless the inconvenience attending it be very great: In which case, if it be the patient's desire, it may be a reason for amputating the limb; or in particular instances, it may be removed by taking out the ends of the bones forming the joint, in the manner to be afterwards pointed out in the last Section of Chapter XLIII. But when the stiffness of a joint depends on a contracted state of the muscles and tendons that serve to move it, which is by much the most frequent cause of distorted limbs, we may almost in every instance afford considerable relief: And where a limb is crooked by a bone being bent, whether it may have happened from improper management during childhood, or as the effect of rickets, or any other disease, we may very commonly, by timely attention, either remove it entirely, or render it much less considerable.

Where a limb is distorted from a stiff  
con-

contracted state of the muscles and tendons which belong to it, a free use of emollients, with a moderate gradual extension, is the remedy from which I have derived most advantage, and which never in any instance does harm. Those who have not been in the practice of using emollients for this purpose, may imagine that they will not penetrate to the depth of the muscles and tendons; and when I first employed them, I must own that I did not expect they were to do so in any remarkable degree: But as I did not know any other remedy that was likely to lubricate so effectually parts that were become stiff, I was resolved to give them a complete trial; and I was soon convinced that the most beneficial effects might be expected from them. In a former publication I had occasion to mention this, and since that period various opportunities have occurred of employing the same remedy with advantage\*.

In order, however, to gain this end,

T 3

emol-

\* *Vide* A Treatise on Ulcers, &c. Part III.



emollient applications must be used in a very ample manner. All the contracted muscles and tendons, from their origins to their insertions, must be well rubbed with the emollient we are to employ for at least half an hour three times a-day; and the limb should be kept constantly moist with, or as it were immersed in, the emollient, by being covered with flannel well soaked in it at every repetition of the frictions. While the frictions are applying, the limb should be slowly, tho' firmly, extended, to as great a degree as the patient can easily bear; and the instrument represented in Plate LXXIX. fig. 1. may be afterwards applied, in order to prevent the muscles from contracting.

It is necessary, however, to remark, that the extension should not be made quickly: By doing so, much mischief has been often produced, inasmuch that joints have become pained and inflamed, where there was not previously any other disease than stiffness of the flexor muscles; while

while it may be done with the utmost safety in the slow gradual manner I have mentioned. In the one way, indeed, several months may be required for effecting what a greater force might accomplish in as many weeks: but the latter must always be attended with pain and hazard, while with the other we proceed with ease and safety.

Even where extension is not necessary, the effects of emollients are often conspicuous. We frequently meet with stiff joints, particularly in the ankle, without any contraction or distortion of the limb. In this case, emollients alone, if duly persisted in, will commonly answer the purpose of relaxing them.

Every kind of greasy application will be useful here, but animal fats prove more relaxing than vegetable oils. The grease of geese and ducks and other fowls answers well; also hogs-lard, and the oil obtained from boiling recent bones of beef and mutton in water. Butchers usually keep this oil in quantities: When pro-

perly prepared, it is quite pure and transparent, and has no smell.

Where the distortion of a limb proceeds from a bone being bent, if this is not of long duration, and especially when it occurs in childhood, we may very frequently be able to remove it by making a constant pressure, gradually increased, on the convex side of the limb, till the bone is brought into its natural direction.

This kind of deformity occurs frequently in patients labouring under rickets; but we find it most commonly in new-born children, either from an original mal-conformation, as we observed above, or from some singularity in the situation of the child while in the womb. It is most frequent in the legs, when it also affects the direction of the feet and ancles. When the bones of the leg are bent outward, the foot is turned inward; and *vice versa*, the foot is turned outward when the leg is bent inward. Patients affected in this last manner are  
called



called Valgi, and Vari when the feet are turned inward.

These distortions of the feet and ancles have been supposed to originate in almost every instance from a mal-conformation of the joint of the ancle; and the means that have been proposed for removing them have been intended to effect an alteration of that joint: They may in some cases arise from this cause, but I have scarcely seen an instance of it. At first view of the disease, we are indeed apt to imagine that the fault lies chiefly in the ancle; but it will be very universally found, on a more narrow inspection, to proceed from the form of the leg. When the leg is bent outward, the toes are turned inward, and the side of the foot downward; or if the curvature of the leg be considerable, the sole of the foot will be turned nearly altogether upward, while the top of the foot will rest on the ground on every attempt to walk: And on the contrary, when the bones of the leg are bent inward, the  
toes

toes and sole of the foot will be turned outward and upward.

Whoever will examine with attention the effect produced upon the foot by the bones of the leg being curved in the manner I have described, will find that the maladies we are now considering must necessarily result from it: And although it may happen, in a few cases, that the joint of the ankle is affected by a long continuance of the distortion, yet in almost every instance the disease will be found to proceed originally from the cause I have mentioned: so that in the management of the disorder, our views should be chiefly directed towards this affection of the leg. By removing the curvature of the bones the foot will gradually regain its natural situation, while all our endeavours will prove fruitless if we only attempt to alter the direction of the ankle-joint.

When cases occur of the foot and toes being turned inward, solely from a mal-conformation of the ankle-joint, it will

no doubt be necessary to endeavour to give the joint a better direction; but as I never met with an instance of this, I must leave the particular mode of effecting it to those who may happen to see it. The easiest and most effectual way of applying pressure to the bones of the leg when bent, is by fixing a firm splint of iron in the shoe, on the concave side of the leg: and if the head of the splint be made to rest against the corresponding condyle of the femur, and the other end of it upon the foot, an easy gradual pressure may be made upon the opposite side of the leg by one or two broad straps passed round both the leg and the splint. If the splint is covered with soft leather and properly fitted to the parts, it gives no uneasiness; and by drawing the strap surrounding it and the leg a little tighter from time to time, the pressure will be increased in the gradual manner I have mentioned. In Plate LXXXIII. an apparatus is represented; which in one case, where the curvature of the leg was very considerable, and  
where



where the sole of the foot was turned almost entirely upwards, answered the purpose very completely. It is sometimes sufficient to fix the small end of the splint in the shoe, and the broad flat pad at the top on the condyle of the femur. A splint for this purpose is represented in fig. 2. This gives it two fixed points, by which we have it in our power to make any necessary pressure with the straps passed round the leg: but in some instances, as in the one I allude to, the sole of the foot cannot be kept so much down as to admit of this, without fixing the shoe to a frame, as is represented in fig. 3. for in every case of this nature, the sole of the foot should be kept as much as possible in a natural situation, otherwise the pressure made upon the leg for removing the curvature in the bones will be apt to give a wrong direction to the joint of the ankle by the under end of the splint, which in this case must be made to rest upon it.

I have thus given a general view of

the



# PLATE LXXXII .

FIG. I.

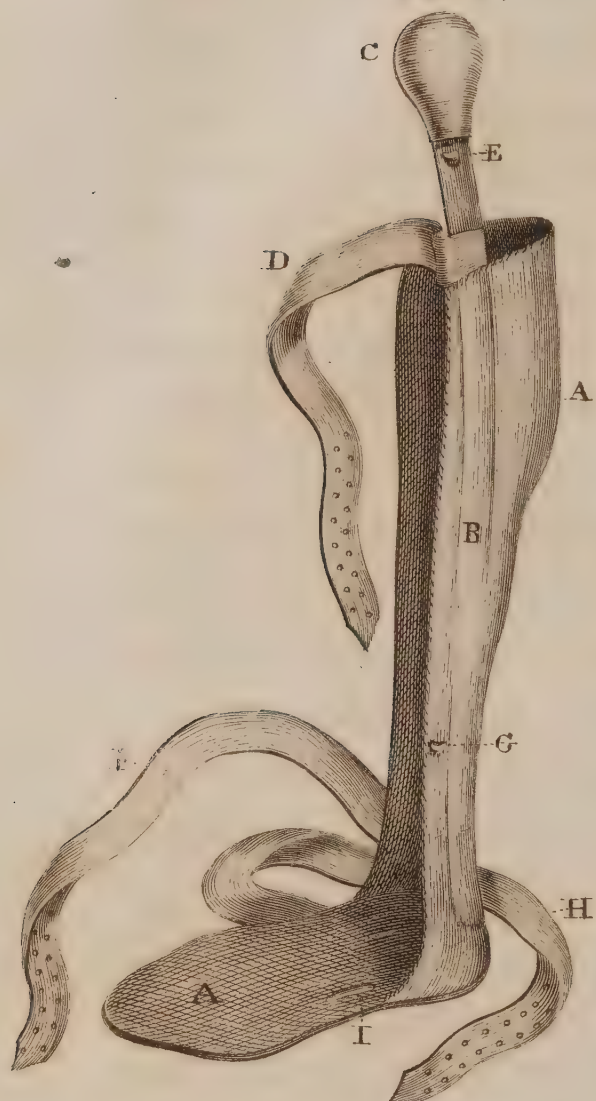


FIG.

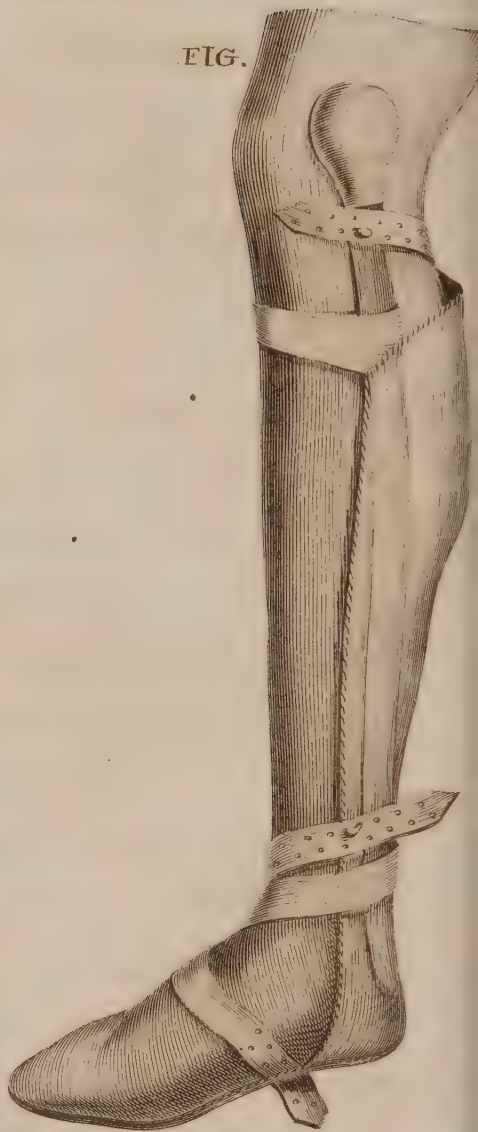


FIG. 3.

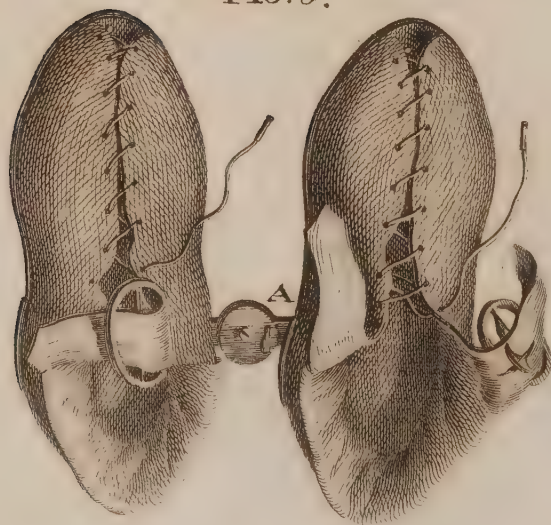


FIG. 4.

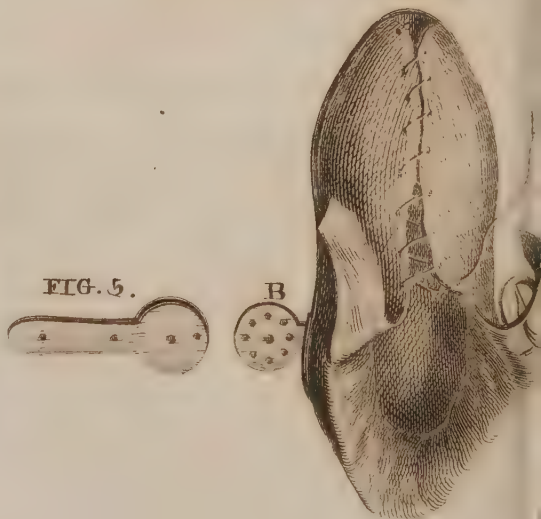
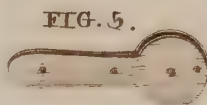


FIG. 5.





the idea I entertain of the nature of this affection, and of the management best adapted for removing it: But whether limbs be distorted from a contracted state of the muscles belonging to them, or from a curvature in the bones, much variety must occur in the application of the remedy, particularly in the manner of applying the extension. The treatment, indeed, which suits one case is seldom exactly applicable to another; it must therefore be varied according to the judgment of the practitioner.

Other modes have been proposed for removing curvatures in bones: Of these the best I have seen is an invention of an ingenious artist of this place, Mr Gavin Wilson, who has long been much employed in this branch of business. In Plate LXXXII. figs. 1. and 2. I have represented one of Mr Wilson's instruments for distortions of the leg.

## C H A P. XLII.

*Of DISTORTIONS of the SPINE.*

THE spine may be distorted in various directions, outwardly, inwardly, and laterally; and in some cases we meet with it in all these directions at the same time and in the same person. This sometimes arises from external violence; but it is more frequently a symptom of a weakly, delicate constitution.

Besides the deformity which these distortions produce, they are very apt to injure the health, by compressing the abdominal and thoracic viscera, and by inducing paralytic affections of the lower extremities, from the pressure which they

2 make

make upon the nerves which supply those parts. They occur in all ages; but more frequently about puberty than at any other period, and more commonly in girls than in boys. In general, the effects which result from them are observed before the cause is suspected; for there is seldom much pain in the part immediately affected.

When distortion of the spine occurs during infancy, the patient appears to be suddenly deprived of the use of his limbs; but at more advanced periods, he complains for some time of feebleness and languor, and of numbness or want of feeling in the under extremities. By degrees this want of sensibility is found to increase; and he is often observed to stumble and to drag his legs instead of lifting them cleverly, nor can he stand erect for any length of time but with much difficulty. At last he loses the use of his legs entirely, which become altogether paralytic; and when the spine is distorted much forward, so as to compress the viscera

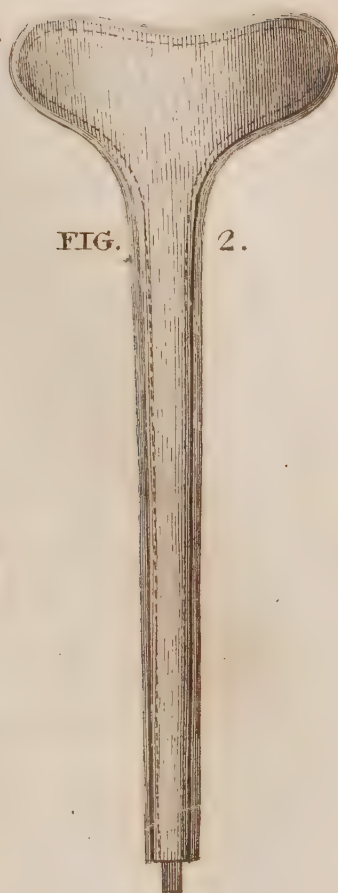
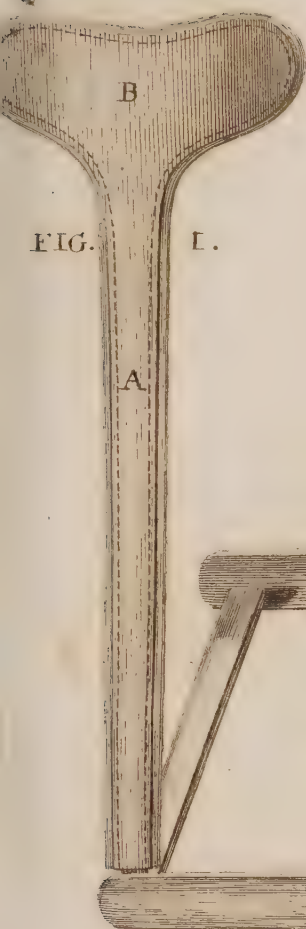


cera of the thorax or abdomen, he becomes distressed with dyspnæa, or complaints in the stomach and bowels, according to the part of the spine that is affected.

In some cases the loss of power in the extremities takes place in the course of a few days from the first approach of the disease; and it sometimes becomes gradually less remarkable, although it never is, so far as I have observed, entirely removed.

When the deformity in the back is discovered, we sometimes find that one of the vertebræ only is displaced; on other occasions two or more are affected; and in some cases there is reason to imagine that it arises solely from a thickening of the ligaments which connect the vertebræ together, without any particular affection of the bones. When one of the vertebræ only is affected, it is observed that the patient is more completely deprived of the power of his limbs than when two or more of them are displaced, owing perhaps to the angle being

# PLATE LXXXIII.







more acute, and consequently the pressure on the medulla spinalis greater when one bone only is thrown out of the range. This also accounts for the paralytic symptoms in some cases becoming less remarkable in more advanced stages of the disease than they were at first; for although one bone only is sometimes displaced at first, yet one or both of the contiguous vertebræ almost constantly yield at last; and the difference which this occasions is so great, that patients almost always linger and die in the course of a year or two, often in less time, when one bone only is deranged; while they live for a great length of time, frequently as long as if no such circumstance had occurred, when the curvature of the spine becomes more extensive.

As distortions of the spine often proceed from delicate weakly patients indulging too much in particular postures, every habit of this kind should be rigidly guarded against on the first appearance of the disorder. If the patient has

been accustomed to lean much to one side, the reverse of this should be advised; and that the body may lie as much as possible upon an equal surface, during sleep he ought to use a hair mattrafs laid upon boards instead of a feather or down bed.

By attention to these points; by the use of an invigorating diet; the cold bath; bark, and other tonics; the disorder has been in some cases prevented from advancing so far as it otherwise probably would have done: but where any of the bones have been affected, I have never seen an instance of a complete cure being obtained. Mr Pott, to whose observations upon this subject we are much indebted, speaks highly of the effect of drains placed as near as possible to the tumor. He advises an issue to be opened with caustic on each side of the tumor, large enough to admit a kidney-bean, and the bottom of the sore to be sprinkled from time to time with powder of cantharides. This I have practised in various

ous

ous cases, and in some instances with obvious good effects: But in all of these there was reason to suppose that the seat of the disorder was in the ligaments, and not in the bones of the spine. When they have appeared to prove useful where the bones have been affected, I conclude that the mitigation of symptoms has arisen from the cause I have mentioned, the pressure upon the spinal marrow being lessened in the progress of the disorder.

Various machines have been invented for the removal of distortions of the spine by pressure: All of these, however, do harm, and ought never to be used. It must at once appear, to whoever is acquainted with the anatomy of these parts and with the nature of this disease, that the displaced bone is never to be pushed into its situation by any assistance of this kind; and if this cannot be accomplished, it is obvious that no advantage is to be derived from the practice, while it is evi-



dent that much mischief may ensue from it.

In all distortions of the spine, it is an object of the first importance to support the head and shoulders. If this be not duly attended to, the weight of the head tends almost constantly to increase the disorder. The collar usually employed for this purpose answers nearly as well as any other. In Plate LXXXVIII. fig. 1. a representation is given of one with some improvements, by which both the head and shoulders may be very effectually supported; and in fig. 3. another is delineated for supporting the shoulders only.

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CHAP. XLIII.Of AMPUTATION.

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## SECTION I.

*General Remarks on the Operation of Amputation.*

**B**Y the term Amputation, we usually understand the removal of a limb. We speak of the Extirpation of a tumor; of the mamma; of a testis; but we say the Amputation of a leg and of an arm.

The mutilation, which is a consequence of this operation, renders it one of the most dreadful in the practice of surgery; yet as the only means by which life can be saved, it is frequently necessary. It is

an operation, however, so repugnant to humanity, so distressful to the unfortunate sufferer, and in some circumstances so fraught with danger, that nothing but a clear conviction of this necessity can warrant our proposing it in any case.

The operation indeed is not difficult: every practitioner accustomed to handle instruments may perform it. But to distinguish with precision the cases which require it from those which might do well under a different treatment, and to determine the particular periods of each when it ought to be performed, are circumstances which require more deliberation than perhaps any other in surgery: We shall therefore enumerate the causes which may make amputation necessary, before proceeding to describe the method of performing it.



## SECTION II.

*Of the Causes which may render Amputation necessary.*

**T**HIS operation may be rendered necessary by various causes; all of which may be comprehended under the following heads.

1. Bad compound fractures.
2. Extensive lacerated and contused wounds.
3. A portion of a limb being carried off by a cannon-ball, or in any other manner, if the bones be unequally broke and not properly covered.
4. Extensive mortification.
5. White swellings of the joints.
6. Large exostoses, whether they be confined to joints, or spread over the whole bone or bones of a limb.

7. Cases of extensive caries, accompanied with bad ulcers of the contiguous soft parts.
8. Cancer, and some other ulcers of an inveterate nature.
9. Various kinds of tumors.
10. Particular distortions of a limb.

Each of these causes we shall consider in the order they are here mentioned.

In Chapter XXXIX. Section XV. we had occasion to speak particularly of compound fractures: I shall at present therefore only remark, as the substance of what was then fully pointed out, that in the army and navy, where ordinary patients cannot be duly attended, and where they must be much jolted, and often removed from place to place, immediate amputation should be advised in cases of compound fractures that are in any degree formidable. Cases will often indeed occur in the worst situations, in which it will be improper to amputate the limbs. Thus, in a compound fracture, where little violence has been done, and where the bones have been

been broke so much in a transverse direction, that when replaced, they support each other with firmness, and especially if one bone only is broke, it would no doubt be a severe, and often an unnecessary measure, to propose the removal of the limb: But whenever much violence has been done to a limb; when the bones are broke in such a manner that they do not, even when exactly replaced, support each other firmly; in all such situations, I believe, it would be a good general rule to advise immediate amputation. Unless the operation, however, can be performed soon after the accident, it cannot again be admissible for a considerable time; for whenever a limb has become swelled and inflamed, it can never, but with the utmost danger, be taken off till these symptoms subside.

In private practice, however, where the patient can from the first be placed in an easy comfortable situation, from which he need not be removed till his cure be completed; where he can be kept



kept perfectly quiet, and have all the advantages of good air, a proper regimen, and the assistance of able practitioners, very few cases will occur in which amputation should be advised. The only cause, as I have observed elsewhere, which in such circumstances can render immediate amputation proper, is the bones of a limb, together with the muscles and other soft parts with which it is covered, being so shattered and bruised that there will be no chance of the limb being rendered useful by any attempt that might be made to save it: In such circumstances it should be removed immediately; but this not being done, the operation, as we have observed above, must be delayed, till the swelling, inflammation, and fever induced by the accident, be removed.

Although early amputation, however, is seldom necessary in private practice, yet, in the after treatment of compound fractures, it is sometimes proper:

1. In consequence of profuse hæmorrhagies,

hagies, which cannot otherwise be stopped. These sometimes happen from one or more arteries being cut by the ends of the fractured bones, as well as from other causes.

2. In consequence of extensive mortification. This we shall have occasion to consider more particularly when we speak of mortification as one of the general causes of amputation.

And, 3. By the ends of the fractured bones remaining long disunited, attended with the discharge of such large quantities of matter that the patient runs some risk of sinking under it.

We have elsewhere observed, that fractures are sometimes prevented from uniting by a loose portion of bone being left, which ought to have been removed; and nothing more readily keeps up a profuse discharge of matter: But when all such pieces of bone have been removed; when no union takes place; or when the discharge still continues in such quantities as to weaken the patient, notwithstanding every thing that can be  
done

done to prevent it ; such as preserving the limb steadily in one posture, regular dressing of the sore as often as may be necessary, a nourishing diet, and a plentiful use of bark ; nothing will in such circumstances so certainly save the patient as the removal of his limb.

We mentioned extensive laceration and contused wounds as the second general cause of amputation. Wounds not accompanied with fractures of the contiguous bones are seldom so bad as to require amputation in any stage of them : But when a limb is so severely lacerated or contused as to have all the large blood-vessels belonging to it destroyed, so as to leave no ground of hope that the circulation can be preserved in it, immediate amputation should be advised, whether the bone be safe or not. As in such circumstances no effort on the part of the practitioner could save the limb ; and as wounds of this description are more apt to terminate in mortification  
than



than any other, the sooner the operation is performed the better.

It will also happen in lacerated and contused wounds, that amputation may afterwards be rendered necessary, although it did not appear to be so at first. In this respect they are similar to compound fractures; and the same observations will apply to them. Hemorrhagies may occur which cannot be stopped; extensive mortification may take place; and such large quantities of matter may form, that the patient will not be able to bear up under the discharge. In any of these events, we have to consider the removal of the limb as the only remedy.

The removal of a portion of a limb by a cannon-ball or other violence, we mentioned as the third general cause of amputation.

This is one of those cases which many contend can never require amputation: for the limb being already removed, it will be better, they allege, to endeavour  
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to heal the sore, than to add to the pain and danger of the patient by an operation. The argument is plausible, but it will not bear examination.

In wounds of this kind the bones are commonly much shattered, and even splintered; and the muscles and tendons are left of unequal lengths, and much lacerated and contused. In this situation, it is allowed by all, that the separate pieces of bone, as well as the sharp ends of the remaining bone, should be removed, together with the ragged extremities of the muscles and tendons. Now all this could seldom, I believe, be done in less time than the operation itself; while by amputating above the injured part, and by covering the bone with sound muscles and skin, we diminish the sore so much that it will probably heal in a third part of the time that the original wound would have required; at the same time that the patient will have a good stump, which in the other method he never could have. With me  
this

this argument of itself would be sufficient for advising the operation under the circumstances we are describing: for as I do not suppose it would add to the patient's risk, any additional momentary pain it might occasion would be amply compensated by the advantage he would afterwards derive from it. When the practitioner has it in his power, the operation should be advised immediately: for however necessary it might be, many patients would not afterwards have sufficient firmness of mind to submit to it; and, from ignorance of the advantages to be derived from it, would prefer present ease to future convenience and advantages, however great they might be.

4. Mortification is the next cause we have to consider by which amputation may be rendered necessary. They who are determined to oppose the practice of amputation as much as possible, affect to consider it as unnecessary in mortification: for all the lesser degrees of it, they observe,



observe, may be cured ; and when very extensive, that the patient will commonly fall a sacrifice to the disease, whether the operation be performed or not. This opinion, however, is so directly contrary to fact, and to the experience of every unprejudiced practitioner, that we shall not attempt to refute it : for although it would be highly improper to advise the removal of a limb in slight degrees of gangrene ; yet when it has spread so extensively as to destroy all or even a great proportion of the soft parts of a limb, an occurrence too frequently met with, what remedy could be employed instead of it ? As I know of none, and as I never heard of any which could in any way prove useful, I shall conclude, that in mortification proceeding to such an extent as we have mentioned, amputation of the limb becomes indispensable.

But although this doctrine will be generally admitted, yet practitioners are not agreed with respect to the period of mortification at which the operation

should be performed. Some contend, that in almost every case of gangrene, and especially where it arises from external violence, the limb should be amputated as soon as mortification is evidently formed, and while it continues to spread: Others are of opinion, that amputation should never be advised till the gangrene is not only stopped, but till the gangrenous are separated from the remaining sound parts.

Those who advise immediate amputation observe, that by taking the limb off above the diseased part, we may prevent the progress of the mortification, and may thus save the patient's life. Altho' the argument is specious, it does not appear to be well founded; and so far as my observation goes, I would say that it is a practice fraught with danger, and ought universally to be discarded: For however attentive we may be in amputating at a part of the limb which appears to be sound, even the most experienced practitioner will be liable to be

deceived. The skin may be perfectly sound, and may be free from pain, inflammation, and swelling; and yet the deep-seated muscles and other parts contiguous to the bone may be in a state of gangrene. Of this I have seen different instances: But even where the whole divided parts are found to be altogether sound, if the operation is performed while mortification is advancing, the disease scarcely ever fails of seizing the stump; at least I never knew an instance of the contrary, and I have unfortunately happened to be concerned in different cases where this practice was adopted. On conversing with practitioners, who, from peculiarity of situation, have much employment in those accidents which are most apt to terminate in gangrene, I also find that their experience tends to support this opinion: It was also the decided opinion of the late Mr Sharpe, as it is of Mr Pott, and of every modern practitioner of observation\*.

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\* Mr Pott's words upon this point are very strong:

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I think it right to mention this, as attempts have of late years been made by some speculative practitioners to introduce a contrary practice; which, if admitted, there is much reason to suspect would prove extremely hurtful, although from its proving so universally unsuccessful, there is reason to hope that it will soon be laid aside, even by those who at present patronize it.

I would not think it necessary, however, to delay the operation so long as is advised by some practitioners, and particularly by Mr Sharpe; who thinks that it should never be performed till the separation of the mortified parts is considerably advanced\*. As Mr Sharpe was a man of much experience, his observation may prove to be well founded; but

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“ I have more than once seen the experiment made of  
“ amputating after a gangrene has been begun ; but I  
“ never saw it succeed ;—It has always hurried the  
“ patient’s destruction.”— *Vide* Remarks on Fractures,  
&c.

\* *Vide* Treatise on the Operations of Surgery, Chap. XXXVII.

so far as I have yet seen, I would consider it as sufficient to wait till the mortification is fairly stopped, but not much longer: In this manner, we seem to reap all the advantages which the caution we have advised can give; and the earlier after this that the mortified parts are removed, the more readily will we prevent the system from suffering by the absorption of that putrescent matter which a gangrenous mass universally yields.

The opinion we have given relates to every variety of gangrene. In whatever way it may have arisen, the practice should be the same; for although some stress has been commonly laid upon the circumstance of its proceeding from an internal or external cause, yet no utility is derived from this. The operation should in no instance be advised till the period we have mentioned; and at that time, whatever may have been the cause of the disease, no delay should be admitted.

5. In mentioning white swellings of the joints as a cause of amputation, we must

must refer to a former publication for the management of the disease, as well as for a more particular account of those symptoms which more especially indicate the operation\*. At present we have only to observe, that as long as there is the least reason to hope that by any means the limb may be saved without hazard to the patient, the operation should never be advised. As a farther motive for this, I may remark, that the opinion I gave in the Treatise alluded to above, has been greatly confirmed by much experience, namely, that amputation more frequently succeeds, that is, a greater proportion recover from the operation when it is delayed till the patient is considerably reduced by the disease, than when it is performed in the more early stages of it. The cause of this may be nearly the same as what we have given above, when advising late Amputation in cases of Compound Fractures.

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\* *Vide* Treatise on the Theory and Management of Ulcers, &c. Part III.



6. In one of the preceding Chapters, we have entered upon the consideration of the various kinds of exostosis\*; so that at present we have only to remark, that when a diseased portion of bone cannot be taken out in the manner we have formerly advised, and when the tumor is either hurting the patient's health or has become unsupportable from its size or any other circumstance, amputation of the limb, when no particular reason prevents it, should be advised as the only remedy.

7. The next cause we have mentioned by which amputation may be rendered necessary is, an extensive caries attended with ulcers of the contiguous soft parts. When speaking of caries, in the seventh Section of the Treatise on Ulcers, we pointed out the different means employed for the cure of the disease, that is, for promoting an exfoliation of the diseased part of the bone. In addition to what we had then occasion to say, it may be

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\* *Vide* Chapter XXXVIII. Section III. § 14.

observed, that although an extensive caries is in general considered of itself as a sufficient reason for amputating a limb, yet it certainly should be admitted under much restriction. However extensive a caries may be, even although it occupies the whole length of a bone, it may be removed; and we have many instances on record of deficiencies produced in this manner being amply supplied by a regeneration of bone: So that where the constitution is sound, and more especially when the patient is young, a carious bone will seldom of itself prove a sufficient motive for removing a limb, at least the chance of saving it by removing the diseased bone should first be given. But when a carious bone is conjoined with deep and extensive ulcers of the corresponding soft parts, which might give much cause to suspect that a cure would not be obtained even although the diseased bone should be taken out, amputation should be preferred; for in this situation, besides the difficulty of

healing the fores, the formation of any considerable quantity of bone would be rendered very uncertain, and therefore the risk should not be incurred.

8. The next cause we have to advert to by which amputation may be rendered necessary, is cancer, and some other ulcers of an inveterate nature.

When speaking of Cancer in the Treatise on Ulcers, we endeavoured to show, that no dependence is to be placed either upon internal medicines or outward applications in the treatment of it; and that the removal of the diseased part is alone to be trusted. It must be acknowledged that cancer does not frequently occur on any of the extremities: but every practitioner must have seen it on different parts of them; and wherever it appears, the removal of the diseased parts with the knife should be advised immediately. They may be often taken away without amputating the limb; but when the disorder has proceeded so far as  
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to attack the ligaments or bones, and especially when the sore is extensive, nothing but the removal of the limb above the parts that appear to be affected can be depended on. In such circumstances, I have known attempts made to save the limb, but always without success. Even the removal of the limb will sometimes fail; but I have known it prove effectual where the disease had returned, after being removed in the usual way.

Besides cancer, other ulcers may, in particular circumstances, render amputation necessary: Where an extensive ulcer, not induced by any general affection of the system, is hurting the health of a patient; and when, instead of yielding to the remedies employed, it becomes evidently more extensive and more inveterate, as it might at last proceed so far as to endanger life; we ought rather to advise the limb to be taken off. Such ulcers as are usually termed Phagadenic sometimes terminate in this manner:

But

But this termination is most frequent in sinuous ulcers ; such as arise from deep-seated abscesses, where the matter has found access between the interstices of the large muscles, and where, notwithstanding our endeavours to accomplish a cure, the discharge continues to be so profuse as to endanger the life of the patient.

9. The next cause we have mentioned which may require amputation, is various kinds of swellings.

Encysted tumors seldom lead to this necessity ; but in some instances where they are deep seated, originating perhaps from the periosteum, if they are allowed to remain till they acquire a great bulk, all the contiguous parts come to be so injured by them, that nothing but the removal of the limb will answer any salutary purpose. In some cases, by a long continued pressure, the contiguous bones are not only rendered carious, but are altogether dissolved ; at the same time that the cellular substance, and even  
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the muscles of the limb, become so much diseased as to give no cause to hope that we could be able to save them.

We sometimes find a portion of a limb considerably enlarged with an uniform hardness in some parts, and in others with a degree of softness which gives cause to suspect that a fluid of some kind or other is collected beneath. The skin at first retains its natural colour; but at last it acquires a livid hue. The commencement of the disease is not attended with pain; but at last it not only becomes painful, but extremely troublesome from its weight. It usually arises without any evident cause, and often in people who are otherwise healthy: At first the swelling commonly appears on the inferior part of a limb, and proceeds gradually up till it occupies the whole of it.

Swellings of this kind are at first often mistaken for common œdema or anasarca; and they seem to be so far of this nature, that they are evidently produced  
by



by an effusion into the cellular substance: but instead of being of the serous kind, the effused fluid is found to be tinged with blood, and of an acrimonious nature; at least this has been the case in all that I have known opened: and it has likewise happened, that the matter has never been discharged in such quantities as to have much influence on the size of the tumors, the swelling usually remaining of nearly the same bulk after the operation as before it; Hence no advantage is derived from it. On the contrary, the operation always does harm. A painful sore is produced; and it always accelerates the progress of the tumor. Indeed, nothing I have ever known employed has any effect in retarding it; so that I consider amputation as the only resource, whenever the tumor has become so large as to create any material uneasiness. Whether this will always prove effectual or not, I cannot pretend to say; but hitherto I have met with no instance of the disease returning where

amputation was performed on a sound part of the limb.

Swellings of the aneurifimal kind have also been considered as a cause which, in particular situations, may give rise to amputation. This has originated from the operation for the aneurism having failed in different instances when performed upon the crural artery, and from the amputation of the limb having in similar affections saved the life of the patient. Where an aneurism in the ham, or on the thigh, is very large, and has been of such long duration as to hurt the texture of the soft parts, as well as to injure the bone, which effused blood is apt to do, it will no doubt be better to amputate the limb than to make any attempt to save it: But in such a case, it is not the aneurism for which amputation is advised, but a morbid state of the parts, induced by the disease being allowed to continue too long before any effectual measure is adopted for its removal. In the commencement, and for

a considerable time thereafter, of the femoral or poplitean aneurism; I should never advise the amputation of a limb: for different instances are on record of limbs being saved by the operation for the aneurism, even where the artery was injured in the superior part of the thigh: But where such an extensive oedematous swelling is induced all over the under part of the limb, as to leave no room to hope that it could again be restored to use, even allowing the operation for the aneurism to succeed, it will no doubt be better to amputate immediately than to attempt the operation.

The aneurism we here allude to is that which proceeds from a dilatation of the artery, and in which the coats of the vessel have burst, so as to produce a considerable effusion of blood into the surrounding cellular substance, probably before any proper assistance is desired. This will seldom happen but with the poorest class of people; and therefore this disease, in the state we are now  
4 speaking



speaking of, is chiefly found in hospitals. At first it is always attended with a good deal of pulsation; but in its later stages the swelling becomes so large that the beating of the artery is scarcely, if at all, discovered; by which it is apt to be mistaken for a tumor of a different kind: But for the most part, a due attention to the history of the case from the beginning, will lead to a knowledge of its real nature.

The 10th and last general cause we enumerated, by which amputation may become necessary, is particular distortions of a limb.

Where a limb is in other respects perfectly sound, it will seldom happen that any distortion to which it is liable will be considered as a sufficient reason for this operation: But in the course of much business, cases are sometimes met with in which limbs are so much distorted, and are productive of so much distress, that patients rather incline to have them removed than submit longer to the  
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inconvenience. When in such circumstances we are not able to remove the distortion by means of a more gentle nature, we are under the necessity of complying with the patient's request.

These are the several causes by which the amputation of a limb may be rendered necessary. As they are very various, and as the loss of a member is to every patient an object of much importance, they merit, in every instance, the utmost attention from practitioners. Indeed this point of practice, namely, that of fixing with precision those cases in which the amputation of limbs should be advised, with the most suitable periods in each, is attended with such difficulty, and a surgeon is so apt to be blamed if he proceeds to the operation so long as the smallest doubt remains of the propriety of it, that it should be held as a fixed regulation with every practitioner, never to operate but with the advice of some of his brethren in consultation,  
when

when this can possibly be obtained. We shall now proceed to describe the method of operating.

### SECTION III.

#### *General Remarks on the Method of Amputating Limbs.*

**S**URGERY is not perhaps in any instance brought to greater perfection than in the method of amputating limbs. Before the invention of the tourniquet, this operation was attended with so much hazard, that few surgeons ventured to perform it: Nay, long after the introduction of this instrument, the danger attending it was so great, that more than one half perished of all who had resolution to submit to it.

In the present improved state of the operation, I do not imagine that one



death will happen in twenty cases ; even including the general run of hospital practice : And in private practice, where due attention can be more certainly bestowed upon the various circumstances of importance relating to the operation, the proportion of deaths will not be so great.

The circumstances in this operation which more particularly require attention, are, the choice, when this is in our power, of the part at which a limb should be amputated ; the prevention of hemorrhagy during the operation ; the division of the skin, muscles, and bones, in such a manner as to admit of the stump being entirely covered with skin ; the tying of the arteries alone, without including the nerve or any of the contiguous parts ; securing the teguments in a proper situation, so as to prevent them from retracting after the operation ; and a proper subsequent treatment of the case.

Next to securing the patient from loss  
of

of blood, the most material of these is the saving such a proportion of the soft parts as will cover the stump, so as to heal the sore as nearly as possible by the first intention: for without this, the wound produced by the removal of a large limb is always extensive; the cure accordingly proves tedious; and in many cases the discharge proves so copious, that the patient's health is irreparably hurt by it. The inconveniences arising from this were so obvious, that various attempts were made, from time to time, to improve this part of the operation. At first, all that was done in amputating a limb, was cutting the soft parts down to the bone by one stroke of a knife, and afterwards dividing the bone with a saw at the edge of the retracted muscles. It was afterwards proposed by Mr Cheselden to divide the soft parts by a double incision; to divide the skin and cellular substance with a circular incision; and then to cut through the muscles at the edge of the retracted skin: by this

means the saw was applied higher in the bone, and the stump was better covered both with muscles and skin. Still, however, an extensive sore was left; inasmuch that in amputations of the thigh, a cure was seldom performed in less than three or four months; often five or six were required; and after all, the stumps were commonly pyramidal, by the bone projecting beyond the soft parts: It often happened too, that another sore was produced by this part of the bone exfoliating, long after the patient considered himself as perfectly well.

To prevent this Pyramidal or Sugar-loaf Stump, as it is termed, a bandage or circular roller was employed, with a view to support the muscles and teguments, and prevent their retracting; and when properly applied from the upper part of the limb downwards, it in some degree answered the purpose, but never so effectually as to prevent the cure from being tedious. In order to shorten it farther, it was proposed by the late Mr Sharpe,



Sharpe, in his Treatise on this Operation, to draw the teguments near together by stitches or pieces of tape passed through them, and tied across the stump: But the pain and inconvenience attending this was so great, that it never was generally practised; and Mr Sharpe himself at last desisted from it.

It was now thought impossible to improve this method of operating, so as to shorten the cure, and in place of a pyramidal, to give the stump a plain surface. In consequence of this, about twenty years ago, different surgeons attempted to revive the flap operation; which had been first practised, upwards of a hundred years ago, by an English surgeon of the name of Loudham. It was effected by saving a flap of the muscles and skin, in the manner we shall afterwards describe, laying it over the stump, and securing it in this situation by proper bandages till it united to the parts beneath.

As this afforded a thick muscular cushion to the stump as well as a complete

covering of sound skin, the highest expectations were formed of it: But the objections to it, which we shall afterwards mention, were so great, that the utmost exertions, even of expert surgeons, to render it more perfect, have not been able to introduce it to general use.

This failure again excited the attention of practitioners to the improvement of the common operation of amputation; and their endeavours have not proved unsuccessful. By the present improved method of operating, such a quantity of teguments is saved as completely covers the stump; by which, in some instances, a cure is obtained by the first intention without the formation of matter: And in all, unless there be something particularly bad in the habit of body, or unless the inflammation unexpectedly runs to a very unusual height, a cure is completed in the course of two or three weeks. As I consider the improvement by which these ends are effected as one of the most important in modern practice, I hope to be

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excused, if I shortly state the share I have had in the introduction of it, before proceeding to describe the operation itself.

In the course of my education, while attending the hospital here, as well as the hospitals of London and Paris, the inconveniences arising from the want of attention to the saving of skin in different surgical operations, struck me strongly; so that I was resolved to take every proper opportunity in my own practice, of treating this point with particular attention.

From the year 1772, when I settled in business, I laid it down as a maxim, not to be deviated from, to save as much skin and cellular substance in the removal of tumors, whether cancers or others, when the soundness of parts admitted of it, as would completely cover the sores; and in amputating any of the extremities, to save as much of them as would entirely cover the stumps. I first performed amputation in the course of that year; and



finding the improvement of saving skin to answer even beyond my expectation, for the cure of a large stump in an amputation of the thigh was completed in three weeks, I did not fail of putting it afterwards in practice both in public and private. The practice was likewise adopted by my friend Mr Hay, and more lately by some other gentlemen in their attendance at the hospital; and ever since that period, Mr Hay and I have invariably adhered to it, some deviations being occasionally introduced in the mode of doing it, with a view of rendering it more perfect; by which the cures have in every instance been greatly shortened. In various cases, large stumps, which by the usual method would have required several months, were cured in as many weeks: In a few, as was observed above, the parts united by the first intention: and in all, a plain uniform stump was produced.

After this had been practised for several years, Mr Alanson of Liverpool, in  
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the year 1779, published some Observations upon Amputation, in which a method of operating is described, which after nine years experience, he recommends in the warmest manner, as answering every object to be expected from this operation; and more especially, that of curing the stumps in a great measure by the first intention.

As Mr Alanson's mode of operating has of late been very deservedly preferred to every other that was before published, I shall afterwards give an account of it; but in the mean time, I shall describe that which I have long been accustomed to practise, and which after various trials of every other of which I have yet heard, I still continue to prefer. In the first place, we shall describe the operation as it is performed upon the thigh, and shall afterwards speak of the method of amputating in other parts of the extremities.

## SECTION IV.

*Of Amputating the Thigh.*

**I**N amputating either the thigh or leg, the patient should be placed upon a table of an ordinary height, with the leg properly secured and supported by an assistant sitting before him. The other leg should likewise be supported, at the same time that the arms should be secured by an assistant on each side, to prevent interruptions during the operation.

The flow of blood to the limb should now be stopped by the application of the tourniquet, in the manner we have mentioned in the first Volume of this Work: and as it is a matter of importance to have the instrument placed as near as possible to the top of the thigh, the cu-  
3 shion





PLATE LXXXIV.

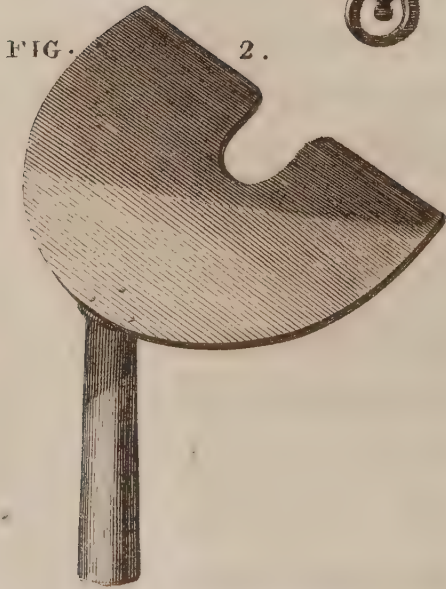
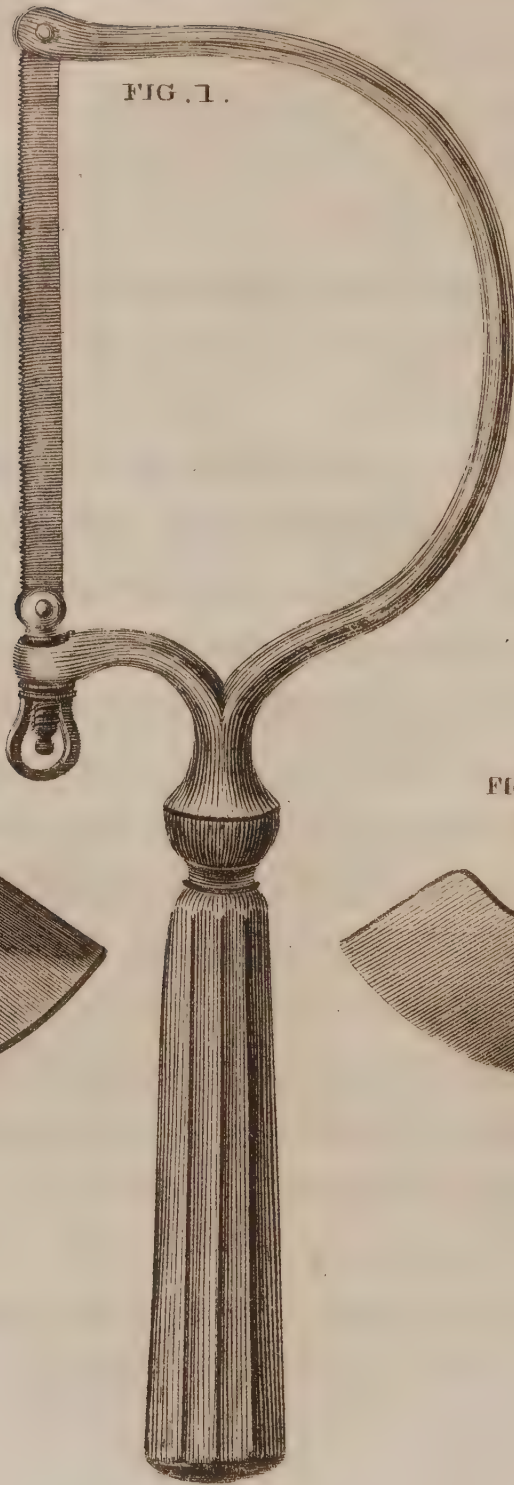


FIG. 4.



shion placed upon the femoral artery should reach the groin.

This becomes absolutely necessary when the operation is to be performed on the upper part of the limb: But it may likewise be done with safety where it is to be taken off immediately above the joint of the knee: And we may just observe, with respect to the most proper place at which a thigh should be amputated, that no more of it should be taken away than is rendered necessary by the disease; for the more of it that is left, the more useful it proves.

An assistant should now be directed to grasp the upper part of the limb with both hands, and to draw up the skin and cellular substance as far as possible: While they are in this state of tension, the operator, standing on the outside of the patient, should divide them with a circular incision down to the muscles: This may in general be done with one stroke of the amputating knife, fig. 3. Plate LXXXV. but in large limbs it is easier



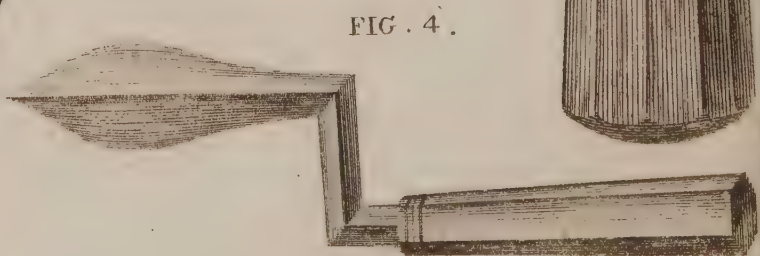
easier done at twice. The assistant continuing to draw the teguments upwards, the cellular substance connecting them to the muscles beneath, should be divided with the edge of the knife till as much of the skin is separated as the operator thinks will cover the stump completely.

The skin being still drawn tightly upwards, the muscles should be divided close to the edge of it down to the bone by one perpendicular stroke of the knife, beginning with the upper part of the large muscles on the inside of the thigh, and continuing the incision round through those beneath, and on the outside till it terminates where it commenced. During this part of the operation, some attention is necessary to avoid the edge of the retracted skin; but it may always be done if the operator be upon his guard, for he may with little difficulty have his eye upon the course of the knife from first to last; nor can this part of the operation be done with safety in any other manner:

Even



PLATE LXXV.





Even where different assistants are employed to protect the skin, it will be apt to be wounded, if the operator does not follow the knife with his eye.

In the usual method of operating, the bone would now be sawn across at the edge of the retracted muscles: but we are more certain of having a good stump, if the muscles be previously separated from the bone for the space of an inch; and it is easily done by inserting the point of the common amputating knife between them, and carrying it freely round from one side of the limb to the other. This being done, the muscles and teguments must be drawn up as far as the muscles have been separated from the bone; and it is easily done, either with a bit of slit leather, such as represented in Plate LXXXIV. fig. 4. or with the iron retractors in the same Plate, figs. 2. and 3. The periosteum should now be divided at the place where the saw is to be applied, and it should be done with one turn of the knife; for where much of it is scraped off,

very

very tedious and troublesome exfoliations are apt to ensue: The knife should therefore be carried round the bone directly beneath the retractors. At this place the saw should be applied, and with long steady strokes the bone should be divided. The saw represented in Plate LXXXV. fig. 1. answers much better than the usual form of the instrument with a heavy iron back. In performing this part of the operation, the assistant holding the leg should be directed to support it with much equality; for if it be raised too far, the motion of the saw will be impeded, while the bone will be apt to be splintered if it be not sufficiently raised. Any points or splinters which may be left, should be immediately removed with the nippers, Plate LVI. fig. 2.

The retractors should now be taken off; and the trunk of the femoral artery being drawn out with the tenaculum, a sufficient ligature should be made upon it before the

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tourniquet is loosened : But as the muscular branches of this artery cannot be discovered as long as any compression remains upon them, the screw should be immediately untwisted so far as to remove it entirely. All the clotted blood should be now removed from the stump with a soft sponge soaked in warm water; and every artery that can be discovered should be secured with a ligature, care being taken to leave the ends of the threads of a sufficient length to hang out without the lips of the wound.

The blood-vessels being all secured, and the surface of the wound cleared of blood, the muscles and teguments should be drawn down till the skin completely covers the stump; and should be retained in this situation by an assistant till a flannel or cotton roller, previously fixed round the body to prevent it from slipping down, be applied in such a manner as to support and fix them : for which purpose it should be passed two or three times, nearly in a circular direction, round the  
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top of the thigh; and should afterwards, with spiral turns, be brought down near to the end of the stump, of such a tightness as to prevent the muscles and skin from retracting, without compressing them so much as to prove painful or to impede the circulation. Here the roller should be fixed with a common pin, while as much of it is left as will pass two or three times round the stump; for a purpose to be afterwards mentioned.

The ends of the divided muscles being placed with as much equality as possible over the bone, the edges of the skin must be laid exactly together, so as to form a straight longitudinal line along the centre of the stump. When there are only one or two ligatures, they should be left out at the inferior angle of the wound; but when there are several, they should be divided between the two angles, to prevent the parts from suffering by a large extraneous body fixed at any one place.

While an assistant retains the edges of the divided skin in exact contact, two or three slips of adhesive plaster should be laid across the face of the stump, to preserve them nearly in this situation; and the whole surface of the stump should now be covered with a large pledgit of soft lint spread with Goulard's cerate, or the common calamine cerate of the Dispensatories: Over this there should be placed a soft cushion of fine tow with a compress of old linen: For the purpose of retaining them, as well as with the view of making a gentle pressure upon the stump, a slip of linen, of three inches in breadth, should be laid over them; and should run directly across, and not from above downwards. On being properly placed, the remaining part of the roller should be employed to fix it, by passing it two or three times round the stump; and the pressure formed by the cross strap may afterwards be increased or diminished at pleasure, by drawing

it with more or less tightness, and fixing it with pins to the circular roller.

While we apply the roller the tourniquet should be removed, and replaced immediately when the stump is dressed. If left loose it gives no uneasiness; and it enables the attendants to check any hemorrhagy which may happen: a circumstance which merits attention for several days after amputation of any of the extremities.

The patient should now be carried to bed; but instead of raising the stump to a considerable height with pillows, as is usually done, it should be laid somewhat lower than the rest of the body: for this purpose, the bed should be made with a gentle declivity from above downwards, and nothing should be put beneath the stump but a little fine tow.

To prevent the patient from moving the limb inadvertently, as well as to guard in some measure against the effect of those spasms which often prove



troublesome after this operation, I commonly employ two flaps of linen or flannel to fix the stump down to the bed. It is easily done, by laying one across near the extremity of the stump, and another near to the root of the thigh. They should be pinned to the circular roller round the limb ; and the ends of each of them should be pinned to the bed : or they may be tied to it by pieces of small tape previously sewed to the bed or to the matrafs ; which answers better than a feather bed for any patient that is to be long confined. A basket or hooped frame should now be put over the stump, to protect it from the bed-clothes ; and whether the patient complains much or not, I make it a constant rule to give him an anodyne, by which he remains quiet and perfectly easy through the remainder of the day, instead of being restless and distressed, which he is otherwise apt to be.

As hemorrhagies will sometimes happen, even many hours after the opera-

tion, the attendant who takes the charge of the patient should be strictly enjoined to examine the stump frequently with the utmost care; and on any quantity of blood breaking out, to twist the tourniquet sufficiently tight to put a stop to it, till assistance is procured. I think it right, however, to observe, that in general it is the fault of the practitioner when this very perplexing occurrence takes place; for it seldom happens when the arteries are searched for in the time of the operation with that accuracy which the importance of the case requires. Indeed hemorrhagies are less frequent after this method of operating than when the muscles are left uncovered; and this is one material advantage that results from it: for however attentive a surgeon may be in securing the arteries, the irritation produced upon an extensive wound, and the spasms which ensue, very frequently terminate in fatal hemorrhagies. Of this I have known several instances; while no discharge  
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of any importance has ever happened in the method of operating we are now describing. I believe too, as I have elsewhere remarked, that some additional security is derived from the use of the tenaculum: for although those who have not been in the habit of using it, are apt to consider it as more uncertain than the needle, yet it is far from being so. I will not say that hemorrhagies will never ensue where the tenaculum is employed; but it has so happened in the course of my observation, that the needle was used in every case of hemorrhagy that proved fatal.

Where there is only a trivial oozing of blood we need not be alarmed; nor will it be necessary to remove the dressings: But whenever the discharge is so considerable as to give cause to suspect that it proceeds from a large artery, nothing but the securing it with a ligature can be depended on. This being done, the dressings must be renewed in the same manner as at first.



The only other symptoms we have reason to dread, during the first three or four days after the operation, are those spasmodic affections of the muscles which we have alluded to above, and the inflammation and tension of the stump, with the consequent fever which in some degree succeed to every case of amputation, but which always prove hazardous when they proceed to any great height.

When the arteries are tied without including the nerves, or any part of the contiguous muscles, these spasms seldom become troublesome: But when they do take place, if laying the limb in as easy a relaxed state as possible does not render them moderate, we must trust to opiates for their removal.

For the prevention of inflammation, the patient must be confined to as low a regimen as the state of his strength will permit. In weak emaciated habits this must be managed with much discretion, as the constitution might be materially hurt by too low a diet: but where there  
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is much plethora, with a tense fibre, together with a strict antiphlogistic regimen, the patient should be bled as soon as quickness and fulness of pulse or other symptoms of fever take place; he should take plentifully of diluent drink; and his bowels should be kept open with any of the cooling neutral salts.

It is proper, however, to observe, that it is during the first days only after the operation that remedies of this kind are in general necessary. When the inflammatory stage is over, evacuations of every kind are to be dreaded; even laxatives are apt to do mischief if they are ever carried farther than is just necessary for preserving a regular state of the bowels.

At the end of the third day, whatever the previous symptoms may have been, the stump should be examined. Where a free suppuration is expected, as always happens when the stump is not covered with skin, the parts should not be looked at till the fourth or fifth day: but here

there is no reason for this delay ; and the patient is always rendered more easy and comfortable by the removal of the first dressings. For this purpose the stump should be gently supported by an assistant, till the last turns of the roller are undone, and till the cross slips, tow, and even the large pledgit of ointment next the sore, are removed. In a few cases the parts will be found to be united by the first intention ; but for the most part it will be otherwise : There will be a small quantity of matter over the surface of the stump, chiefly at the inferior angle of the wound ; and the parts will be red, tense, and painful to the touch, with a small separation or opening between the edges of the divided skin, notwithstanding the plasters employed to retain them. As in this state the plasters will do no service, they should likewise be removed ; and it is easily done when they are thus moistened with matter. The surface of the stump should now be covered with a pledgit of  
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the same ointment as at first; and a cushion of soft tow being laid over it, the cross slips of linen and circular roller should be again employed; but with no more pressure than is merely necessary for supporting them.

In this manner the dressings should be renewed every second day; when, by the seventh or eighth day, the inflammation and tension will in general be so far diminished as to admit of the ligatures on the arteries being easily removed; at least they may now be gently pulled daily, and for the most part they will yield on the second or third trial: when allowed to remain longer, they not only prevent the wound from healing, but are apt to be more difficult to remove afterwards.

As long as the roller is preserved clean, it may be allowed to remain; but as soon as it becomes sullied with matter, it should be removed and another applied in its place; nor should it be entirely laid aside till the third or fourth week

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from the operation. After this period, however, it should be removed, as when longer continued it is apt to render the limb smaller than the other.

As soon as the fore is observed to be perfectly clean, with granulations sprouting up in different parts of it, as the pain and tension will now be quite removed, we may with safety venture to complete the cure, by drawing the edges of the wound together by adhesive plasters. In this state of the fore no harm ever ensues from it, and it shortens the cure considerably.

By this management, even the largest stumps will for the most part be healed in three or four weeks; often in less. But it must be remarked, that although we may in general depend on this in private practice, where every circumstance that can conduce to the welfare of the patient will meet with attention, and where especially we may always obtain a well-ventilated apartment and proper diet; yet in public hospitals,

hospitals, where these points cannot be duly attended to, and where the patient often suffers more from the bad air which he breaths, than from the operation itself, the success attending it will not in every case be so great. Instead of the teguments adhering readily to the parts beneath, large quantities of matter sometimes form between them, which always renders the cure more tedious, and which in some cases cannot be accomplished but by sending the patient to a more free air, and by a more plentiful allowance of wine and other cordials than can in general be obtained in hospitals. But for one instance of this kind, in the operation we have described, I may with safety affirm, that twenty will occur in the usual mode of conducting it: In the former, those obstacles to a cure do not commonly occur; in the latter, they are often observed.

When speaking of the time in which stumps may be expected to heal, I think it right to observe, that it should not be  
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our object to accomplish a cure in the first instance without the formation of matter: It commonly answers better when effected in the more gradual manner we have pointed out. When a stump heals suddenly, and the edges of the divided skin adhere by the first intention, the teguments are apt to be puckered and uneven, and the ligatures of the arteries are removed with difficulty. Of this I have had different cases, when such strong adhesive plasters were made use of as kept the edges of the skin in close contact: But when the common court-plaster is made use of, or any other composition possessed of the same degree of adhesive property, although the teguments will be prevented from separating to any considerable extent, yet they will readily yield to the retraction which usually takes place on the accession of tension and pain. In this manner, a slight separation is usually produced; by means of which the ligatures are easily taken out; any matter that may form is readily discharged;

charged; the corners left above and beneath, by the teguments being drawn together, are much lessened; and the stump is always left smooth and equal: Hence those stumps which take three weeks or perhaps a month to heal, are usually better than those which heal much sooner. The advantages attending a speedy cure, and the covering the stump with skin, are so great, that they need not be enumerated; but I thought it right to mention the inconveniences which occur from our endeavouring to hasten the union of the divided skin too quickly, either by adhesive plasters, or futures, which last has in some cases been attempted.

It will be readily perceived, that the principal difference between this operation and the usual method of amputating, consists in the saving of as much of the muscular substance of the limb as will completely cover the bone, together with as much skin as will cover the whole surface of the stump: But it is proper to remark, that we may err in  
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saving more of each of these parts than is requisite, and that some attention is therefore necessary to guard against it. In leaving too much muscular substance, we must necessarily shorten the limb too much, by sawing the bone higher than we otherwise would do; and by saving too much skin, we render the surface of the stump puckered and uneven.

With respect to the quantity of muscular substance that should be saved, I have hitherto found, that the directions given above, in general, answer the purpose. By separating the muscles from the bone for the space of an inch, and sawing it at this height, above where it is divided in the ordinary method of amputating, the bone will always be sufficiently covered with flesh; and a very little experience enables us to judge of the quantity of skin that should be saved for covering the stump: But even when more is saved than is altogether necessary for this purpose, a little attention will enable us to prevent inequalities. By  
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an assistant drawing down the teguments, in the manner we have directed, before the roller is applied, as much of them may be pulled down as is just necessary; and if they are preserved in this situation till the application of the roller is finished, any inconveniency which might have occurred from too great a quantity will be prevented.

It will likewise be observed, that in making the first incision of the teguments, I have not desired a circular piece of tape to be made use of, as is usually done, to serve as a direction for the knife. This deviation from the common practice has been long adopted by some individuals; but so far as I know, it was first suggested by the late Doctor Hunter of London; and I think it a material improvement of this part of the operation: for besides the saving of time, which is always of importance in that state of anxiety to which a patient is reduced who is placed upon a table for the purpose of losing a limb, it in reality puts it in our power  
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to make the incision with more neatness, more speedily, and with less embarrassment, than when the tape is employed. Those who have been accustomed to the tape will at first be of a different opinion; but whoever will lay it aside, will find, that the circular incision may be made with more exactness merely by following the knife with the eye; and I am certain that it may be done in one half of the time. When the tape is employed, a good deal of time is lost in endeavouring to keep the knife exactly in a line with it; and if it be not applied with the utmost exactness, it necessarily renders the incision ragged and unequal; an occurrence I have observed in different instances, even with expert surgeons, while I never perceived any inequality where the tape was not used.

It has been objected to the operation now described, that being more tedious than the usual method of amputating, it must necessarily create more pain. The difference in this respect, however, must be

be trifling; for it must be remembered, that the incision of the skin, which is the most painful part in every operation, is the same in both. The division of the cellular substance is quickly performed, and little or no pain ensues from it: And the third incision, if we may so term it, or the separation of the muscles from the bone, may be performed in the tenth part of a minute. In different instances I made use of a scalpel for separating the cellular substance from the muscles beneath, as well as for separating the muscles from the bone; but I now find that both these parts of the operation may be done with the common amputating knife with equal ease and expedition: and we should avoid multiplying instruments, wherever the intention can be answered equally well with a smaller number. The knife delineated in Plate LXXXV. fig. 3. is the one I now prefer, after trying various forms of it: It is of a middling size, somewhat shorter than the one in common use, and perfectly straight. The curved



knife is still used by some practitioners, but I have never heard any good reason given for it.

If any surgeon should find it difficult to separate the muscles from the bone with this knife, the instrument recommended by Mr Gooch, and delineated in Plate LXXXV. fig. 4. may be employed.

I shall now describe such parts of Mr Alanfon's method of performing this operation as are peculiar to himself; and in order to convey the meaning of the author with exactness, I shall give it in his own words from the second and last edition of his book, page fifty-first.

“Apply the tourniquet in the usual way; stand on the outside of the thigh; and let an assistant draw up the skin and muscles, by firmly grasping the limb circularly with both hands. The operator then makes the circular incision as quickly as possible through the skin and membrana adiposa down to the muscles: He next separates the cellular and membranous attachments with the edge of his knife,

knife, till as much skin is drawn back as will afterwards, conjointly with the following division of the muscles, cover the surface of the wound with the most perfect ease.

“ The assistant still firmly supporting the parts as before, apply the *edge* of your knife upon the inner edge of the musculus vastus internus, and at one stroke cut obliquely through the muscles upwards as to the limb and down to the bone; or, in other words, cut in such a direction as to lay the bone bare about two or three fingers breadth higher than is usually done by the common perpendicular circular incision: now draw the knife towards you, so that its point may rest upon the bone, still attending to keep it in the same oblique line, that the muscles may be divided all round the limb in that direction by a proper turn of the knife; during which its point is kept in contact with, and revolves round, the bone.

“ The part where the bone is to be laid bare, whether two, three, or four fingers breadth higher than the edge of the retracted integuments; or, in other words, the quantity of muscular substance to be taken out in making the double incision, must be regulated by considering the length of the limb, and the quantity of skin that has been previously saved by dividing the membranous attachments.

“ The quantity of skin saved, and muscular substance taken out, must be in such an exact proportion to each other, as that by a removal of both the whole surface of the wound will afterwards be easily covered, and the length of the limb not more shortened than is necessary to obtain this end. However, it is to be observed, that the more muscular substance we save, by fully giving the oblique direction to the knife, instead of dividing the membranous attachments, the better.”

Mr Alanson now gives some directions for the use of the retractor; for securing the



divided arteries with ligatures; and for the application of the flannel roller: Afterwards he proceeds thus.—“ You are now to place the skin and muscles over the bone in such a direction as that the wound shall appear only in a line with the angles at each side; from which points the ligatures are to be left out, as their vicinity to either angle directs: The skin is easily secured in this posture by long slips of linen or lint, about two fingers in breadth, spread with cerate or any other ointment: if the skin do not easily meet, it is best brought into contact by slips of linen spread with sticking plaster. These are to be applied from below upwards across the face of the stump, and over them a soft tow pledgit and compress of linen, the whole to be retained by the many-tailed bandage, with two tails or slips to come from below upwards to retain the dressings upon the face of the stump.”

Mr Alanson uses a knife with a double edge, which he thinks preferable to the one commonly employed.

As I wish the author's ideas to be clearly understood, I think it right to add, that in page 17. he directs the bone to be laid bare three or four fingers breadth higher than is usually done by the common perpendicular incision of the muscles : That is, that by the oblique direction of the knife three or four fingers breadth of muscular substance should be scooped out. And in page 21. he observes, that " a stump formed in the thigh, agreeably to the foregoing plan, if you bring the parts gently forwards after the operation, and then view the surface of the wound, may in some degree be said to resemble a conical cavity, the apex of which is the extremity of the bone : " and the parts thus divided, he observes, are obviously the best calculated to prevent a sugarloaf stump.

From what has been said, it will appear, that Mr Allanson's method of operating differs chiefly from that which I have advised above, in the manner of  
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dividing the muscles and in the after position of the skin. Every surgeon is apt to be partial to that mode of operating which he has been accustomed to practise; but being always anxious to have this very important operation improved to the highest possible degree, I was resolved to give Mr Allanson's method a fair trial, being hopeful from the accounts received of it, that I should find it answer better even than that which I have spoke so highly of. I can with truth however assert, that it did not answer my expectation. The stumps formed by it are indeed much better than can be made by the usual method of amputating; but the removal of such a large portion of muscular substance, as is done by Mr Alanson's oblique incision, produces a hollow, which not only retains the matter, but which prevents the stump from being so smooth and equal as when the skin is supported by a flat muscular surface in the manner we have advised. Mr Alanson, who is in the daily practice of it, may be able to



obviate these difficulties ; but I know that I cannot make such a good stump in this manner as I always do in the other method of operating ; nor is Mr Alanson's own idea so completely answered by his method of operating. He very properly observes, page 63. that in the thigh we want a sufficient cushion between the bone and machine to be used in walking ; that the more muscular substance that is saved, the farther will the point of bone on which the pressure principally produces inconvenience, be removed from the surface of the machine ; and likewise, that a more vigorous circulation will be kept up all round the extremity of the bone and stump, which lessens the danger of exfoliation. Now it is obvious, that the end of the bone will not be so much covered with muscular substance when a considerable portion of the muscles is removed by the oblique incision as when they are allowed to remain ; nor will the circulation be so vigorous round the end of the bone.

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But admitting Mr Alanfon's method of operating to be in every point equal to the other, the greater difficulty of performing it is a weighty objection to it. Indeed few, I believe, will be able to divide the muscles by the oblique incision without mangling the skin, even with the explanation given by Mr Alanfon in the last edition of his book. Accordingly we find, in page 204. that this actually happened in the hands of an expert surgeon, Mr Lucas of Leeds, even where the division of the muscles was not begun close under the retracted integuments, but a little lower. Nor will this be an uncommon occurrence, if the muscles are divided with the edge of the knife, as is directed by Mr Alanfon. I have divided them with the point of the knife, but with difficulty; for the point cannot be easily carried round to the height of three or four fingers breadth above the retracted skin, so as to make a smooth equal cut. I do not see how the edge of the knife can be applied to cut so obliquely upwards

wards without hurting the skin; and yet Mr Alanfon's words are, "apply the edge of your knife, and at one stroke cut obliquely thro' the muscles," &c. He desires indeed, that the incision may be finished with the point; but I do not understand how it can be done without cutting the skin, if the point be not employed from first to last. Indeed Mr Alanfon himself admits that there is difficulty in this part of the operation; for in page 18. he says, "that while one assistant continues a firm and steady elevation of the parts, another should attend to preserve the skin from being wounded as the knife goes through the muscles at the under part of the limb." This of itself appears to be a material objection to this method of operating: For two assistants, whose hands are all employed nearly at one point, must be apt to embarrass not only each other but the operator: And besides, it must often happen that two assistants cannot be procured.

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With respect to the line of direction in which the wound should be closed, Mr Alanfon observes, page 67, if it be formed from above downwards, the cicatrix will generally be found directly opposite to the bone ; by which, in walking with an artificial leg, the point of pressure must be upon the new-formed skin ; which he thinks will be avoided by forming the line in the contrary direction from side to side : in which case, after the cure is complete, it will be found, that in consequence of the more powerful action of the flexor muscles, the cicatrix is drawn downwards, and the extremity of the bone is therefore covered with the old skin ; by which the greatest pressure falls upon this part, and not upon the new formed skin.

I have not found, however, that this argument is of much importance : for this retraction of the flexor muscles which Mr Alanfon alludes to is in a great measure owing to the custom of elevating the stump after the operation, and

may be prevented by keeping it lower than the rest of the body in the manner we have mentioned. And besides, the bone is so well covered with muscular substance, and the cicatrix is so narrow when the operation is rightly done, that I have not met with a single instance of any inconveniency arising from this circumstance mentioned by Mr Alanfon: whereas, the lodgement of matter proves always so troublesome and pernicious, and would in all probability occur so frequently, were the practice generally adopted of making a transverse opening instead of a longitudinal one upon the face of the stump, that this appears to be a sufficient reason for preferring the former.

With a view to prevent that inequality on the surface of the stump, which arises from the retraction of the flexor muscles of the thigh, I have in some cases divided these muscles an inch lower than those of the rest of the limb. After dividing the skin and cellular substance with a

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circular incision in the usual way, this is easily done; and it prevents this inconvenience effectually: but it is not necessary when the stump is treated in the manner we have mentioned.

Whether others may deem these observations upon Mr Alanfon's method of amputating important or not, I cannot determine; but as they appeared to me to be of consequence, I thought it my duty to offer them.

It is but justice, however, to remark, that the public is much indebted to Mr Alanfon for his assiduity in endeavouring to improve this very important operation, and for the many useful practical remarks contained in his publication.



## SECTION V.

*Of Amputating the Leg.*

**I**N amputating the thigh we observed, that as much of the limb should be saved as can be done with propriety; for the longer the stump the more utility is derived from it: But in the amputation of the leg, it has hitherto been almost a general rule to take it off a little below the knee, even where the disease for which it is advised is seated on or near the ankle, and where accordingly the operation might be performed much lower. The reason given for this is, that a few inches of the leg being saved answers as a sufficient rest to the body in walking when the limb is inserted into the box of a wooden leg; and when much more of it is left, that it proves troublesome

some both in walking and sitting, without being attended with any particular advantage.

Were we to conclude, that the common practice of bending the joint of the knee and resting upon the anterior part of the leg was necessary, this method of operating a little below the knee would be admitted as the best: But as we have now had many instances of patients walking equally well with machines so contrived as to admit of the use of the knee-joint; as these machines, by resembling the human leg, are much more pleasing to the eye than the wooden ones in common use; and as the operation may be done with much more ease and safety to the patient a little above the ankle, I am of opinion that it should always be advised to be done here whenever it is practicable, instead of the ordinary place a little below the knee.

The operation is easier done a little above the ankle than at the upper part of the leg, by the parts to be divided being  
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less extensive : for the diameter of the leg is here considerably less ; and it is done with more safety by our being able to cover the bone more completely with soft parts, so as to accomplish a cure in the same manner and equally soon as in the thigh : Whereas, immediately below the knee, the bones are not only larger, but there is such a scarcity of soft parts, that the cure proves always much more tedious, notwithstanding all our endeavours to promote it ; inasmuch, that in operating at the usual place, about four inches beneath the patella, the fore, with all the attention we can give to it, will seldom heal in less than ten or twelve weeks ; and in the common method of forming the double incision, it will even require four or five months : Whereas, when the operation is rightly performed a few inches above the ankle, a cure may for the most part be effected in a fortnight or three weeks.

It is true that a method of amputating beneath the knee has been proposed, by  
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what is termed the Flap Operation, and by which a cure may be more speedily effected than in the usual way of operating; but still it is tedious, and at the same time is liable to other objections, which we shall have presently occasion to mention. I therefore conclude, that in every case that admits of it, amputating a little above the ankle is preferable to operating immediately below the knee.

We are next to determine the most proper place for the operation, when we are prevented by the extent of the disease in the leg from amputating lower than the usual place beneath the knee. Where the upper part of the leg is found, it has hitherto been a fixed maxim to amputate below the joint of the knee rather than above it.

While practitioners were unacquainted with the present improvements in the operation of amputation, they seem to have adopted this maxim, chiefly from finding that the body rested more easily

upon the sound skin on the fore-part of the leg than on the stump of the thigh: But now that the operation may be done above the knee, so as that the fore will heal in less than one half of the time that is required when a leg is taken off immediately below the joint, and in such a manner that the stump is covered with sound skin, as well as with some muscular substance, which admits of the patient resting upon it with freedom; this reason, upon which the practice is chiefly founded, falls to the ground.

We have observed above, that the cure of a stump immediately below the knee is always tedious, owing to the great extent of bone at this part, and the natural deficiency of soft parts.

Upon the whole, therefore, I conclude, that amputation immediately below the knee should seldom or never be advised: But as no innovation will at first be generally admitted, I think it right to describe the method of operating  
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when it is determined to amputate at this part.

The patient should be placed upon a table, and secured in the same manner as in operating above the knee. The tourniquet should be applied a little above the knee, with the cushion upon the artery in the ham. The foot and leg should be secured by an assistant sitting before the patient, while the teguments are drawn up by another assistant towards the knee. The surgeon, standing on the inside of the leg, should now with the knife, Plate LXXXV. fig. 3. make a circular cut through the skin and cellular substance down to the muscles, so far down upon the limb, that when as much of the teguments are separated from the parts beneath as will cover the stump, the muscles and bones may be divided immediately below where the flexor tendons of the leg are inserted. The interosseous soft parts must be divided either with the point of the amputating knife or with the catline, Plate



LXXXV. fig. 2. The retractors, Plate LXXXIV. figs. 2. and 3. must now be applied so as to support and protect the skin and other soft parts from the saw employed for dividing the bones. This being done, and the vessels secured, the teguments should be drawn over the stump and retained with adhesive plasters, in the manner we have advised in amputating the thigh. The practice, indeed, should be the same during the whole course of the cure ; only, in the application of the flannel roller, there is no necessity for beginning at the top of the thigh : It should receive, however, two or three turns above the knee, to prevent it from slipping down.

In separating the adhesions of the skin from the parts beneath, as much of the cellular substance should be taken along with it as can be got ; otherwise the circulation in the skin itself is apt to become so languid as to prevent it from adhering to the parts on which it is applied. It will be found too, that more attention is necessary to destroy the attachment-

tachments of the skin in this situation, particularly on the fore-part of the leg, than on the thigh, owing to the cellular substance being more condensed where it lies so contiguous to the bone, than in the thigh, where the muscles intervene. And as this state of the cellular membrane prevents the teguments from retracting freely after they are divided; and as they cannot even be pulled sufficiently up by the assistant, it is necessary to fold such of them as are separated from the parts beneath back upon the sound skin, before the division of the muscles be attempted; otherwise the skin will either be cut with the knife, or the muscles will not be divided so high as is necessary.

Always at this part of the leg, and in a few cases immediately above the ankle, I have found it necessary to fold the skin back in this manner; but hitherto no instance has occurred in the thigh, but where the operation might have been done merely by pulling the teguments

up, in the manner we have formerly mentioned.

We have desired above, that in this operation the surgeon should stand on the inside of the leg: By this means, if the knee and foot be turned inwards, so as to raise the fibula, the saw may be applied in such a manner to both bones as to divide them nearly together; which is the surest method of preventing them from breaking when they are nearly sawn through: Whereas, on standing on the outside of the patient, the fibula will be more apt to be left to the last; at the same time that the saw will be applied upon the ridge of the tibia so as to act upon its longest diameter, by which it will not be so quickly divided.

In operating above the ankle, that spot should be fixed upon which will leave the stump of the most convenient length for being fitted with a leather machine resembling the other leg. And I find from observation, as well as from the information of Mr Wilson, an ingenious tradesman



tradesman of this place, that nine inches from the joint of the knee is the best length for this purpose; for it affords a sufficient support to the machine, and at the same time prevents it from being so heavy and clumsy as when the leg is left of a greater length: for when taken off immediately above the ankle, the stump must go down to the very bottom of the machine, which must therefore be made thicker and heavier at the ankle than would otherwise be required; at the same time that it will prevent it from corresponding so exactly as it otherwise would do to the size of the other leg.

In addition to what we have said upon the method of amputating the leg immediately below the knee, we may observe, that in operating above the ankle, it should be done exactly as we have advised in describing the Amputation of the Thigh: Only in this situation, instead of muscles, we find a portion of both bones covered merely with skin and cellular substance; but as the cellular

membrane is here commonly sufficiently lax, and in greater quantity than in the upper part of the leg, it is not only more easily separated from the periosteum, but serves to give the bones a more complete covering: By which, when the operation is properly done, the cure for the most part is accomplished in less than three weeks, and the surface of the stump is equal and every where covered with sound skin.

## SECTION VI.

### *Of Amputating with a Flap,*

IN performing the operation of amputation in the usual way, the cures were so extremely tedious; the health of the patients was thereby so much injured; and the stumps, when healed, were so pyramidal, and so thinly covered with soft

soft parts, that, another method of operating, as we have observed above, was proposed upwards of 'a hundred years ago; in which an attempt was made to obviate these difficulties, by preserving a flap of muscles and skin for the purpose of covering the stump.

This was first proposed by one Loudham, a British surgeon: It was afterwards practised in Holland, Germany, Switzerland, and France; and more lately by some individuals in Britain and Ireland; but it has never been received into general use, nor is it probable that it will ever be frequently performed.

The chief objections to it were, the difficulty of restraining the hemorrhagy when it happened to recur after the flap was applied and fixed in its situation by sutures; for in order to discover the bleeding arteries, it was necessary to undo the whole; the flap not adhering uniformly over the whole surface of the stump; and the pain, inflammation, and tension, which supervened, being much  
more



more severe than after the usual method of operating.

To remove these difficulties, it was proposed, about twenty years ago, by Mr O'Halloran, an ingenious surgeon of Limeric, to dress the stump and flap as separate sores for the first twelve days; when the risk of hemorrhagy being over, the symptoms of pain, inflammation, and tension, subsided, and suppuration established, we are directed to turn the flap back upon the surface of the stump, and by means of plasters, compression, and bandage, to secure it in this situation till they unite together.

By this improvement the operation was rendered more safe and certain; and it is probable that it would gradually have come into general practice, if the improved method of operating, which we have already described, had not in the mean time been introduced: But although this method will probably continue to be generally preferred, yet in particular situations, the operation with

the flap may with much propriety be employed. Wherever the divided parts cannot be properly covered with skin in any other manner, it ought certainly to be done with a flap: and this will always be the case in amputating the arm at the shoulder, and the thigh at the hip-joint, as well as in removing any of the fingers or toes: It may likewise by some be preferred to the method of operating which we have described, when it is resolved to amputate immediately below the knee; for the teguments being in this part extremely thin, some will be apt to imagine that the stump cannot in any other manner be sufficiently covered. But for the reasons we have already mentioned, it can never be necessary, either above the knee; in operating above the ankle; nor in the arm or fore-arm. Some, however, may continue to prefer it, even in these parts: so that it will be proper to describe the method of doing it in all of them. This we shall attempt in the following Sections.

## SECTION VII.

*Of Amputating the Thigh at the Hip-Joint.*

THE amputation of the thigh at the hip-joint has always been considered as one of the most hazardous operations, and therefore we have very few instances of its being performed. Indeed surgeons in general have spoke of it as one of those operations which authors might describe, but which would never be practised: and when we consider the great size of the blood-vessels which supply these parts; the difficulty of commanding the hemorrhagy during the operation; and the very extensive wound which, in the usual method of operating, must necessarily have ensued here; we will not be surprised at the aversion which has generally prevailed against it.



But if these difficulties can be removed ; if danger from hemorrhagy can be prevented during the operation, as well as afterwards ; if the fore can be so completely covered with skin as to be healed in the course of a few weeks ; and if cases ever occur which would otherwise end in the death of the patient ; we surely would not hesitate in advising it. Now, we hope to make it appear, that the operation may be done with very little loss of blood ; and that as much skin may be saved as will cover the fore entirely : and no practitioner will doubt of diseases taking place at the top of the thigh, which cannot be removed but by amputating the limb.

Having already treated fully of the causes by which amputation of limbs may be rendered necessary, we shall now refer to what was said upon that part of the subject ; and at present shall only observe, that gun-shot wounds, accompanied with fractures of this part of the bone ; spina ventosa, or caries of the head of the femur, will be the  
most

most frequent causes of amputating at the joint of the hip. When the operation is resolved upon, it may be performed in the following manner :

The patient should be placed upon a table ; and it will be found that the parts that are meant to be divided will be brought most clearly into view by laying him on the sound side. In this situation he should be secured by two or three assistants, while another assistant takes the management of the limb.

Let a small pad or cushion be now placed upon the femoral artery, immediately after it passes out from beneath Poupart's ligament into the thigh ; and, by means of a tourniquet applied as near as possible to the top of the limb, let the circulation be completely stopped. Let the skin, *membrana adiposa*, and tendinous fascia of the thigh, be divided by a circular incision six inches from the top of the thigh ; that is, at least three inches beneath the circular band of the tourniquet. Let the retracted skin be pulled an inch upwards ; and at  
the

the edge of it let the amputating-knife be applied, so as with one perpendicular circular stroke the muscles may be cut down to the bone. If the muscles be freely divided, they will retract so much as to admit of sufficient space for securing not only the femoral artery but all the muscular branches. This being done, take a strong round-edged scalpel, larger than the common size, and commencing at the upper edge of the circular cut on the posterior part of the thigh, make a deep incision down to the bone, and carry it up of the same depth to a little above the great trochanter into the joint. Let a similar cut be made on the opposite side of the limb, at a sufficient distance from the femoral artery, and completely down to the bone. Let the two portions of flesh be now dissected from the bone, and the flaps formed by them be taken care of by assistants, while any artery that may be cut should be tied as soon as it is observed. The joint being laid bare, some dexterity will be required



quired to disengage the head of the femur from the acetabulum; for it is rendered difficult from being tied down to it by the ligamentum rotundum: But by turning the bone in different directions, and particularly by pressing it inwards, where it yields most readily from the brim of the acetabulum being lowest, the head of it will be so far turned out of the socket on the opposite side as to admit of the ligament being reached with the point of a scalpel or a firm probe-pointed bistoury; but to accomplish this, the muscles must all be previously detached from the bone.

The head of the bone being taken out and the limb removed, we may examine the state of the acetabulum: for if it be sound, our prospect of a cure will be more favourable than if any part of it be carious. But in whatever state the bones may be, our treatment of the sore must be the same: we must endeavour to cure it as nearly as possible by the first intention: For which purpose, after

re-

removing all the coagulated blood from the surface of the wound; placing the muscles as nearly as possible in their natural situations; and drawing the two flaps together, so as to cover the sore as neatly as may be; they should be secured in this situation by three or four sutures introduced at the most proper points; by adhesive plasters; and by proper compresses retained with a broad flannel roller passed different times round the body, and spirally over the stump; care being taken to leave the ligatures upon the arteries of a sufficient length to admit of their being afterwards drawn out.

The patient should now be laid in bed, and treated in other respects as we have advised in general after the Operation of Amputation: Only it must be remarked, that more than ordinary attention will be required to prevent and remove such febrile symptoms as usually succeed to amputation; for where such a considerable part of the body is suddenly taken away, almost a fourth part of the whole,

we may reasonably conclude that the effect produced by it upon the system must be considerable. If the patient is plethoric, it will be proper to diminish the quantity of blood; in the first place by venæsection, and afterwards by a low diet: Indeed moderate living should be persevered in, if not for life, at least for a great length of time.

The dressings may be removed at the usual time, and in the course of ten or twelve days the ligatures may be all taken away; when any part of the fore that remains open may be covered, by drawing the skin over it, and securing it with adhesive plaster. In such an extensive fore, it is indeed probable that matter may collect in different parts beneath the skin; for the pressure applied upon it, will not be so equal as in common cases of amputation: but the inconvenience arising from this will not be great; for if the matter cannot be discharged by altering the pressure, it will be easily done with the point of a lancet,



cet, by which this obstruction to the cure will be removed.

At all times this will necessarily be considered as a very formidable operation: But when performed in the manner we have advised, much of the hazard, and many of the inconveniences usually supposed to attend it, will be removed; nor should any practitioner accustomed to operate, hesitate in performing it, when the life of a patient will otherwise be endangered. By the tourniquet, we effectually command the circulation in the limb till all the large blood-vessels divided by the circular incision are tied; and by securing the different arteries that are cut in making the longitudinal incisions as soon as they appear, the loss of blood will be inconsiderable: Nor will there be any risk of hurting the femoral artery in the course of separating the flap in which it is seated from the bone, if it be done with caution.

It may be alleged, that by this method

of operating, more of the teguments and muscles will be saved than are necessary for covering the fore: But it must be remembered, that the fore will here be very extensive, and that the divided muscles will retract considerably. And besides, the tourniquet could not be applied if the first cut was much higher than we have directed; by which the operation would necessarily be rendered much more dangerous: Nor can any risk occur from the teguments and muscles being left somewhat longer than might be just required for the purpose above mentioned, while much inconvenience would ensue from their being deficient.

In the sixth volume of the Medical Commentaries of Edinburgh, a case is recorded, in which the thigh was amputated at this joint by Mr Kerr surgeon in Northampton. In this case, the division of the femoral artery was reserved to the last; nor was the tourniquet employed. No hemorrhagy indeed occurred;

red; but there was surely more risk of this than if the operation had been done in the manner we have advised: Nor could the operator use such freedom with the bone, in removing the head of it from the socket, as long as the blood-vessels remained undivided. We may remark, however, that this case affords an instance of this operation being practised with safety: For although the patient died, yet she lived eighteen days after the operation, and at last died from a different cause, when all risk of hemorrhagy was over, and when the sore had even a favourable appearance.



## SECTION VIII.

*Of the Flap Operation immediately above the  
Knee.*

**W**HEN this operation is to be performed above the knee, it may be done either with one or two flaps, but it will commonly succeed best with one. It is most convenient to have the flap on the fore-part of the thigh; for here there is a sufficiency of soft parts for covering the bone, and the matter passes more freely off than when the flap is formed in any other direction.

The patient being placed upon a table, the tourniquet being applied in the usual way at the top of the thigh, and the teguments drawn firmly up and retained by an assistant, the extent of the intended flap should be marked with ink.

A

A person much accustomed to this operation may not require this assistance; but it will be done with more neatness and exactness if the form and extent of the flap be previously marked.

The extreme point of the flap should reach to the end of the limb, unless the teguments be in any part diseased; in which case, it must terminate where the disease commences, and its base should be where the bone is to be sawn. This will determine the length of the flap; and we must be directed with respect to the breadth of it by the circumference of the limb: For, the diameter of a circle being somewhat more than a third of its circumference, although a limb may not be exactly circular, yet by attention to this circumstance, we may ascertain with sufficient exactness the size of a flap for covering a stump. Thus, a flap of four inches and a quarter in length, will reach completely across a stump whose circumference is twelve inches; but as some allowance must be made for

the quantity of skin and muscles that may be saved on the opposite side of the limb, by cutting them in the manner we have directed, and drawing them up before sawing the bone; and as it is a point of importance to leave the limb as long as possible, instead of four inches and a quarter, a limb of this size, where the first incision is managed in this manner, will not require a flap longer than three inches and a quarter, and so in proportion according to the size of the limb. The flap at its base should be as broad as the breadth of the limb will permit, and should be continued nearly, although not altogether, of the same breadth to within a little of its termination, where it should be rounded off so as to correspond as exactly as may be with the figure of the fore on the back part of the limb. This being marked out, the surgeon standing on the outside of the limb should push a straight double-edged knife with a sharp point to the depth of the bone, by entering the point of it at the  
outside



outside of the base of the intended flap; and carrying the point close to the bone, should push it through the teguments at the mark on the opposite side. The edge of the knife must now be carried downwards, in such a direction as to form the flap, according to the figure marked out; and as it draws towards the end, the edge of it should be somewhat raised from the bone, so as to make the extremity of the flap thinner than the base; by which it will apply with more neatness to the surface of the fore. The flap being supported by an assistant, the teguments and muscles on the back part of the limb should, by one stroke of the knife, be cut down to the bone about an inch beneath where the bone is to be sawn; and the muscles being separated to this height from the bone with the point of the knife, the soft parts must all be supported with the leather retractors, Plate LXXXIV. fig. 4. till the bone is sawn; and any splinters that may be left, are cut

cut off. All the arteries that discharge much blood must now be secured in the usual way with the tenaculum, the ligatures being left of a sufficient length for hanging out at the edge of the flap.

The muscles and teguments should now be drawn down and secured with a flannel or cotton roller, in the manner we have advised when a leg is amputated with a circular incision; and the flap may now be laid down over the surface of the fore, so as to effect a cure as much as possible by the first intention; or it may be dressed as a separate sore, agreeable to the practice of Mr O'Halloran, according to the judgment of the operator. If it is to be applied immediately, the coagulated blood should be carefully sponged out, and it should be secured to the muscles and teguments surrounding the rest of the stump by three or four sutures passed at least three quarters of an inch into the muscular substance of the flap: But care should be taken not to draw

draw the ligatures so tight as to create much irritation or pain. The under part of the stump should now be covered with a large pledgit of common cerate; and a cushion of soft tow being laid over it, the whole should be secured in the manner we have formerly advised, with cross straps of linen and a few turns of a circular roller.

In three or four days the dressings may be renewed; and as soon as the ligatures are all removed, and the tension and inflammation induced by the operation abated, any part of the fore which was not covered at first may now have the skin drawn over it, and secured with adhesive plasters.

But if Mr O'Hallaron's method is to be adopted, the easiest mode of proceeding is this. The muscles and teguments being drawn down and secured with the roller, let the whole surface of the stump be covered with a pledgit of soft lint spread on both sides with any soft emollient ointment: Let the flap be laid  
down



down upon this ; and another pledgit of the same kind being laid over the whole with a cushion of tow and a compress of soft linen, the cross straps and circular roller should be employed to support them, but with no more pressure than is necessary for this purpose. At the end of three or four days the dressings may be renewed in the same manner ; and about the twelfth or fourteenth day, or whenever the tension induced by the operation is removed, the ligatures all taken out, and a proper suppuration established, the flap may be brought into contact with the sore beneath with a view to make them unite. For this purpose, any matter that may be observed upon the surface of either of them should be gently removed with a soft sponge ; and the flap being laid down with as much exactness as possible, it may either be secured with adhesive plasters supported by the bandage above mentioned, or two or three futures may be employed. This last method will give more  
pain

pain than the other; but this will be amply compensated by the flap being retained in its situation with much more certainty and exactness.

Farther experience must evince which of these methods should be preferred, for as yet it is not determined. It is my own opinion, that the secondary union recommended by Mr O'Halloran is the best: for the pain, tension, and inflammation which ensue from the other, run often so high as to render it necessary to remove the dressings and even the ligatures; by which a great deal of additional trouble is given to the practitioner and much distress to the patient: whereas, when the tension and inflammation are gone before the flap is laid down, little or no pain is induced by it; nor is the cure effected in this manner more tedious: On the contrary, it would appear to be in general accomplished more quickly in this way than in any other. Even where the flap has not been ap-  
3      plied

plied to the sore till the fourteenth day, the cure has been completed before the fourth week : Whereas few, if any, cures have been effected so early where the flap has been applied immediately after the operation.

In operating with two flaps, the following is perhaps the easiest method : The patient being placed upon a table, and the tourniquet applied, let the skin be drawn up by an assistant, and a circular incision be made through the teguments and muscles down to the bone at the most inferior parts of the limb, with the edge of the knife turned obliquely upwards : Let the sharp-pointed knife, mentioned above, be now pushed through the skin and muscles on one side of the limb down to the bone, at that part where the bone is to be sawn ; and the under edge of the knife being turned obliquely outwards, let the muscles be divided down to the circular incision. The teguments and muscles on the opposite side of the limb must now be divided



vided by a similar incision, when any of the intermediate soft parts that may have been left must likewise be cut; and the bone being sawn, and the vessels secured with ligatures, the cure may either be attempted by laying the flaps together immediately, or they may be kept separate twelve or fourteen days, and treated afterwards in the manner we have advised above.

## SECTION IX.

### *Of the Flap Operation below the Knee.*

**I**N speaking of this operation below the knee, it is not necessary to describe all the steps of it. The views of the operator are the same here as in operating above the knee, and the method of effecting them is nearly similar.

I

After

After the previous steps of the operation are taken, the size and form of a flap sufficient to cover a considerable part of the fore must be marked out with ink; this must be separated from the parts beneath in the manner we have already advised: The rest of the soft parts must be divided, taking care to save as much of the teguments on the side of the limb opposite to the flap as with the flap itself will nearly or entirely cover the fore; and the cure must afterwards be conducted either by applying the flap immediately, or after the symptoms of pain, tension, and inflammation induced by the operation are gone, and treated in the manner we have advised in the last section.

It must be observed, however, that in operating beneath the knee, the flap cannot be formed on the fore-part of the limb as is done in the thigh; for on this part of the leg there is no muscular substance; and for this reason, we are advised by authors to form the flap on the  
back-

back part of the leg. But this is liable to one very important objection, the difficulty of preventing matter from lodging between the flap and the fore after they are brought into contact: for it must be remarked, that it is moderate pressure only which we dare venture to apply to the flap; so that it is scarcely possible to prevent the matter from collecting where it does not find a free vent below.

Instead of forming the flap from the muscles of the back part of the leg, it may be done with more propriety upon the outside of the limb, where there is a sufficient quantity of muscular substance for this purpose. The point of the knife should be entered on the outside of the ridge of the tibia at the part where the bone is to be sawn; and being carried backwards in a direct line, and at a proper depth to the opposite side of the base of the flap, the edge of it must afterwards be carried down the line previously marked with ink as a direction



for the form and length of it. In this manner the bones may be covered with a flap of a sufficient thickness, while the matter which forms in the progress of the cure, finding a ready outlet by the inferior edge of the flap, will not be allowed to lodge.

In operating immediately above the ankle, there is a necessity for leaving the flap behind, for there is not a sufficient quantity of soft parts to admit of it in any other situation. But we have elsewhere observed that the leg should never be taken off so immediately above the ankle, as it leaves the stump too long for a machine to be rightly adapted to it for the purpose of walking: But at nine inches from the condyles of the femur, which in an adult is the most proper length for this purpose, the flap may with propriety be formed, in the manner we have mentioned, on the outside of the leg.

## SECTION X.

*On Amputating the Foot, Toes, and Fingers.*

WHEN the whole foot is diseased, it becomes necessary to take off the limb at the part we have mentioned above the ankle; nay, this should be done even where the parts about the joint are sound, if all the rest of the foot is diseased: For although some have recommended the amputation of the foot at the joint of the ankle, yet the practice should not be adopted, as the fore cannot be properly covered, nor is the stump when of this length so useful: But when any considerable part of the foot remains sound, it ought undoubtedly to be saved, and the diseased part of it only removed. I have seen a whole foot taken

D d 2

off,

off, where two of the metatarsal bones only have been diseased : while, on the contrary it should be laid down as a fixed rule, to remove the diseased parts alone, even where two of these bones only remain sound ; for with the assistance of a shoe properly stuffed, and with a firm unyielding sole, even a very small part of the foot proves useful in walking : And this especially when the bones on the inside of the foot, or those corresponding to the great toe and those next to it, are left.

When the middle part only of the foot is diseased, the metatarsal bones on each side remaining sound, these should be left, and the diseased part only taken out. In this case, the affected bones should be taken out at the joint whether they be diseased through their whole length or not ; for although instruments might be invented for cutting even a single bone across in the centre of the foot, the operation would necessarily be much more tedious, and more painful,  
than



than the removal of the bone at the joint, at the same time that little or no advantage would be derived from saving a small portion at the end of it. But where one, two, or three of the bones on either side of the foot are only partially diseased, as in this case it becomes an object to save as much of the foot as possible, the operation should be so conducted that the bones may be sawn across nearly at the termination of the diseased parts.

In every case of amputation, it is an object of importance to save as much skin as will cover the fore; but it is particularly necessary in amputating any part of the foot where the effect of friction is much to be dreaded in walking. In making the incision, therefore, at that part of the bone where the saw is to be applied, it should be done in such a manner, that a flap may be saved of a sufficient size for covering the fore. With a little attention this may always be done, nor is it often attended with any diffi-

culty ; for the flap may be formed either above or below, or on one side of the toe, according as the teguments are found or otherwise. But it is proper to remark, that where the skin is found, it answers best to save it below ; as in this situation it is firmer, and therefore more able to resist the effects of pressure.

This operation is most easily performed when the patient is placed upon a table. The tourniquet should be applied above the knee, with a compress placed upon the artery in the ham ; the limb should be firmly secured by assistants ; and on sawing the bone, a piece of pasteboard, or thin splint of timber, should be inserted between it and the contiguous sound bone, to protect the latter from the teeth of the instrument.

The diseased parts being removed, and any artery that is cut secured, the flap should be applied as exactly as possible to the sore, and retained with slips of adhesive plaster and gentle pressure with a flannel roller. If futures are employed,

ployed, they should be inserted in such a manner as to avoid the flexor and extensor tendons of the toes and foot.

In amputating the toes and fingers, the operation used formerly to be done by one stroke with a chisel and mallet; but this is liable to many objections, and has been long in disuse. In general, fingers and toes are amputated in the same manner with the larger extremities, either by preserving a flap sufficient for covering the fore, and afterwards dividing the bone with a small spring saw represented in Plate LXXXIV. fig. 1. or by the double incision, performed in the manner we have advised in Section IV. of this Chapter. But instead of this, it has for several years been the practice of some individuals, to amputate fingers and toes at the joints; and whoever will give it a fair trial, will readily prefer it. The patient being placed upon a table, and the limb properly secured, a flap should be marked with ink of a sufficient size for covering the fore. This



being dissected from the bone with a scalpel, and supported by an assistant, a circular incision should be made through the rest of the soft parts, a little below the joint, and on a line with the base of the flap. The lateral ligament should now be cut ; and in order to determine the point at which this should be done, an assistant should be directed to move the finger. This ligament being divided, the joint is easily dislocated, when the remainder of the operation may be quickly finished. If it is necessary to tie an artery, it should be done with the tenaculum. The flap must be applied to the fore, and secured as neatly as possible with adhesive plasters, and moderate pressure with a flannel roller.

The only objection that has been made to this practice is, the supposed uncertain union of the contiguous soft parts with cartilage. But we now know, that there is no cause for this apprehension, and that a flap will unite as readily with  
cartilage

cartilage as with bone, at least I have uniformly observed this to be the case; and we find from Mr Alanson's publication, that the practice has proved very successful in the course of his experience.

## SECTION XI.

*Of Amputating the Arm at the Joint of the Shoulder.*

THIS operation having always been considered as hazardous and difficult to perform, it has not frequently been attempted: But although it should never be advised when our purpose can be accomplished by amputating lower, yet no practitioner of modern times will decline it, when the life of a patient cannot in any other manner be saved. Abscesses

cesses in the joint, caries of the humerus reaching to the joint, compound fractures extending to the head of the bone, gunshot wounds and mortification, may render amputation of the arm at the shoulder necessary.

The operation may be performed with safety by any surgeon of steadiness and experience, and who is possessed of an accurate knowledge of the anatomy of the joint and contiguous parts.

It may be done in different ways; but the following I believe to be the best.

The patient should be placed upon a table of a convenient height, covered with a mattress and blanket; and he should be laid upon his back, and properly secured by assistants, as near as possible to one side of the table.

The next object is to guard against hemorrhagy: for this purpose we might advise the tourniquet to be placed upon the upper part of the limb, in a manner similar to what we have proposed in amputating



putating at the hip-joint. But here it is unnecessary, as the blood may be completely stopped in its flow to the arm, by compressing the subclavian artery as it passes over the first rib: for this purpose, an assistant should be properly placed, with a firm cushion or compress applied upon the course of this artery directly above the clavicle, who with his fingers should make such a pressure as may be necessary: It will readily be known whether it proves effectual or not, by its influence on the pulsation at the wrist.

The circulation being stopped, the diseased shoulder should be made to project somewhat over the side of the table; and the arm being stretched out and supported by an assistant at nearly a right angle with the body, a circular incision should be made through the skin and cellular substance just at the insertion of the deltoid muscle into the humerus. The teguments may be allowed to retract about half an inch; and at the edge of the  
retracted

retracted skin, the knife may be applied so as to divide the muscles with a perpendicular circular cut down to the bone. Thus far we proceed with the common amputating knife; but the remainder of the operation should be finished with a scalpel. With a firm round-edged scalpel a perpendicular incision should now be made down to the bone, commencing at the acromion, about half way between the centre of the deltoid muscle and the inner edge of it, and terminating in the circular incision about an inch above, or rather on the outside of the brachial artery. This being done, a similar cut must be made on the back part of the arm, commencing at the same height with the other, and ending in the circular incision. This should be at such a distance from the first, that the two flaps formed by them both may be nearly of an equal breadth. The brachial artery should be tied as soon as it is cut by the circular incision through the muscles; and any anastomosing muscular branches of arteries that may be cut  
cut

cut on the upper and back part of the joint should be tied immediately on being observed. The two flaps should now be separated from the bone, care being taken to avoid the large artery in dissecting off that part of the flap with which it is connected. An assistant must support the flaps so as to bring the capsular ligament of the joint into view; when an opening being made into it, the head of the bone will be easily dislocated by drawing the arm backward; and this being done, the operation will be easily finished by dividing the remaining part of the ligament.

Any arteries that may have been cut about the joint being tied, the ligatures hanging out at the most depending part of the wound, and the parts cleared of coagulated blood, the two flaps should be laid together so as to cover the joint as neatly as possible, and retained in their situation by two or more futures. A pledgit of lint spread with any emollient ointment should now be laid over the

3 joint;



joint; and a soft cushion of tow or of lint, with a compress of old linen, being applied over the whole, a flannel roller should be employed to make a moderate pressure upon the joint; by which the flaps will be kept in contact with the parts beneath, which will not only facilitate their union, but will be the most effectual method of preventing matter from lodging.

In other respects, the patient should be treated as we have advised in the preceding Sections, when speaking of Amputation in the Lower Extremities. With a view to prevent any risk from hemorrhagy after the operation, an assistant of experience should sit with the patient for the first two or three days, with directions to apply pressure above the clavicle in the event of any considerable quantity of blood being discharged, till the bleeding vessel can be secured with a ligature. In the course of eight or ten days the ligatures upon the arteries will come easily away. If matter collects

collects beneath any part of the skin, it must be discharged; and if the patient is healthy and no untoward circumstance happens, a cure may soon be expected.

Till of late, it was the practice in this operation to tie the brachial artery and veins with a ligature before proceeding farther. This gave much unnecessary pain, at the same time that it did not render the patient more secure. In the way we have mentioned, the operation may be performed with no risk from the hemorrhagy; and by tying the artery at the extremity of the flap, several muscular branches will be saved which would be cut off by tying it near the axilla.

Mr Bromfield, in the first volume of his *Observations and Cases*, has given the best account yet published of this operation. The principal difference between this method of doing it and the one we have described, consists in the latter being more simple, and therefore more easily performed. By dividing the mus-

cles down to the bone with a circular incision, the operation is more speedily done than by cutting first one muscle and then another, in the manner mentioned by Mr Bromfield. And as the attachments of the latissimus dorsi, the deltoid and pectoral muscles, as well as of all the other muscles of the arm, are removed by the arm being taken away, there is no necessity for proceeding with slowness and caution in dividing them; nor is it necessary to employ two ligatures upon the brachial artery, one considerably higher than the other, as is advised by that author; one ligature applied in the usual way with the tenaculum is quite sufficient, if it be done with care and attention. And Mr Alanson very properly observes, in speaking of this operation, that there is no necessity for scraping off the cartilage from the acetabulum of the joint, as is recommended by Mr Bromfield; for we find by experience, as we have observed in  
the



the last Section, that the teguments adhere to cartilages as readily as to bone.

## SECTION XII.

### *Of Amputating the Arm.*

THE general observations we have made upon the method of amputating the thigh and leg, apply with the same propriety to the amputation of the arm and forearm. At present, therefore, we shall only observe, that in amputating the arm, no more of it should be removed than is diseased; for the longer the stump is, the more useful it proves: and the same attention should be given to the saving of teguments for covering the fore that we have advised in Amputating the Leg. But it is proper to remark, that this may always be done both in the arm and forearm without the assistance of a flap: for there is in every part of both a sufficiency

both of muscles or cellular substance, for admitting of the fore being completely covered by amputating with the double incision, in the manner we have pointed out; and wherever this can be done, it should be preferred to the method of operating with a flap.

CHAP.

C H A P. XLIV.

*Of removing the Ends of BONES in Diseases  
of the JOINTS.*

THE amputation of limbs is more frequently advised for affections of the joints than for any other cause; and as this often happens where the rest of the limb is sound, it were to be wished that with safety and propriety we could remove such parts as are diseased, and leave those that are sound. In compound fractures and dislocations, the ends of large bones have frequently been sawn off, when such parts of them have pro-



truded as could not be replaced. The deficiency thus produced, has in most instances been supplied by nature; and thus the limbs have remained almost equally useful as before. In a few cases too of diseased joints, a cure has been obtained by the head of a bone being sawn off. Among other instances of this to be met with in books, a remarkable one is recorded by a very ingenious and expert surgeon, Mr White of Manchester, who preserved an arm by sawing off the head of a diseased humerus\*. But Mr Park of Liverpool was the first who ventured to propose it as a general remedy in affections of the joints†. Whether or not it will stand the test of experience, farther trials must determine; but in the mean time, the public are much indebted to Mr Park for the pains he has taken

\* *Vide Cases in Surgery with Remarks, Part I. by Charles White, F. R. S. &c.*

† *Vide An Account of a New Method of Treating Diseases of the Joints of the Knee and Elbow, by H. Park.*

taken to introduce a less formidable remedy in place of amputation.

What Mr Park proposes is, that instead of amputating a limb for any external violence done to a joint, for a white swelling, a caries, or any other affection, that the diseased ends of the bones should be sawn off; when nature, he thinks, will commonly supply the deficiency of bone; by which the limb will be preserved, and will prove more useful than any machine that artists can invent.

Mr Park supposes that this operation will be chiefly applicable to affections of the knee and elbow, and more particularly to those of the latter; and he relates a case of white swelling of the knee in which it was practised with success: The under extremity of the femur and the upper end of the tibia were sawn off; no artery of importance was injured; the vacancy produced by the removal of the ends of the bones was supplied with callus: in the course of ten weeks a cure of the sore was obtained; the

limb became so firm that the man has since been able to go to sea as a sailor, and he does not even use a crutch.

This, however, is the most favourable view of the proposal; and it is proper to remark, that in the course of the cure, much perplexity occurred from various circumstances; particularly from the difficulty of preserving the limb in a steady fixed situation; from the great depth of the wound; from the lodgement of matter; and from the formation of sinuses. By much attention on the part of Mr Park, all these difficulties were surmounted: But although the merits of the operation must be determined by farther trials, yet the risk attending it appears to be so great, that there is much reason to suspect that it will never be generally practised.

For a more particular detail of the method of doing it, and of the after-treatment of the sore, the publication itself must be consulted; but for the advantage of those who may not easily meet with  
it,



it, the following short account of the operation is inserted in Mr Park's own words.

“ An incision was made, beginning about two inches above the upper end of the patella, and continued about as far below its lower extremity : Another, crossing this at right angles, immediately above the patella, the leg being in an extended state, was made through the tendons of the extensor muscles down to the bone, and nearly half round the limb ; the lower angles formed by these incisions were raised so as to lay bare the capsular ligament : The patella was then taken out, and the upper angles were raised, so as fairly to denude the head of the femur, and to enable me to pass a small catlin across the posterior flat part of the bone immediately above the condyles, taking care to keep one of the flat sides of the point of the instrument quite close to the bone all the way. The catlin being withdrawn, an elastic spatula was introduced in its  
E e 4 place,

place, to guard the soft parts while the femur was sawing through: Which done, the head of the bone thus separated was carefully dissected out; the head of the tibia was then with ease turned out and sawn off, and as much as possible of the capsular ligament dissected away, leaving only the posterior part covering the vessels; which, on examining, I had the satisfaction to find had not only escaped unhurt, but that it was not a very narrow escape: They had still a pretty good covering, and had been through the whole operation far enough out of the course of the knife. It must be confessed, that the appearance of the wound was somewhat formidable, exhibiting a very large cavern with very thin parietes; and in short, there seemed little wanting to complete the amputation: Yet as the limb below would not be deprived of any part of its nourishment, and as every healthy incised surface, as well of bone as of soft parts, has a natural tendency to granulate, I could not see any  
room

room to doubt that nature would be able to repair the breach."

Mr Park afterwards informs us, that he attempted to perform the operation without making the transverse incision: but he found it could not be done; and after spending some time in the attempt, it was thought advisable to desist from it. More than two inches of the femur, and rather more than one inch of the tibia, were removed; which were but just enough to admit of the leg being brought into a right line with the thigh, the previous contraction of the flexor muscles being such as to keep the two sawn ends of bone in close contact: This produced a considerable redundance of the teguments. To support this, that it might not fall inward, and to keep the edges of the incision in apposition till they should acquire some degree of firmness, a few stitches were passed through the skin; not merely along the course of the transverse incision, but upon that part of the longitudinal cut that extended up  
the



the thigh. The lightest superficial dressings only were applied, and the limb placed in a case of tin from the ankle to the insertion of the gluteus muscle.

Mr Park very candidly enumerates several objections which may be made to this operation; but at the same time, he thinks that all of them may be obviated. There are two, however, which, in my opinion, will always appear with force against it: The first is, that where the bones of large joints are so much diseased as to render it necessary to remove them, the surrounding soft parts are for the most part so much thickened, inflamed, or ulcerated, as to render any attempt to save them very uncertain, and much more hazardous than the amputation of the limb: And the second is, the high degree of inflammation which commonly succeeds to wounds of the larger joints.

With respect to the first of these, Mr Park himself wishes it to be understood, that it is chiefly in affections of the joints

produced by external violence, that he thinks this operation will be peculiarly useful; and, with respect to the last, he observes, that the heads of large bones have been frequently sawn off, without any violent symptoms ensuing: and as he supposes this to be owing to the very free division of the capsular ligaments, which in such cases must always take place, he thinks that the total removal of this ligament, which he advises in this operation, will in a great measure prevent it. We have observed above, that experience alone can determine upon the merits of this operation; but we cannot avoid remarking, that no necessity appears for the removal of any part of the capsular ligament. It may be highly proper to make the opening into it free and large; but to remove it, by dissecting it off from the contiguous parts, must probably add to the risk of the operation, by rendering the inflammation more severe than it otherwise might be; at the same time that it must necessarily  
render

render it much more painful as well as more tedious. Farther experience may perhaps set this in a different point of view: but at present we see no more reason for removing any part of the capsular ligament in this operation, than for the removal of the tunica vaginalis testis in the operation for the hydrocele; a practice now altogether laid aside, even where the cyst is much thickened.

CHAP.



## C H A P. XLV.

*Of Preventing or Diminishing PAIN in*  
CHIRURGICAL OPERATIONS.

**T**O be able to alleviate the misery of those who are obliged to submit to dangerous operations, must afford the highest gratification to every practitioner: And as pain is the most dreadful part of every operation, it necessarily demands our most serious attention.

The pain induced by operations may be lessened in different ways: By diminishing the sensibility of the system; and by compressing the nerves which  
supply

supply the parts upon which the operation is to be performed.

Narcotics of every kind might be employed for the purpose of lessening general sensibility; but nothing answers this with such certainty and effect as opium.

But as medicines of this kind, when given in such large doses as to prevent or diminish pain, are apt to induce sickness and vomiting, I seldom venture on giving them before an operation. In general they prove most useful when given immediately after, when they very commonly alleviate that pungent foreboding of which patients at this time usually complain; and by continuing to give them in adequate doses from time to time, we are often enabled to keep the patient easy and comfortable, till relief is obtained by the formation of matter, or by the removal of that inflammatory tension which usually accompanies every capital operation: And as this proves not only highly comfortable to the patient, but tends in the most effectual

man-





PLATE LXXXVI.

FIG. 1.

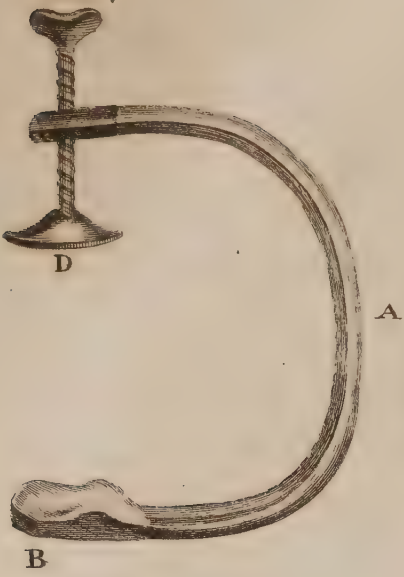


FIG.

2.

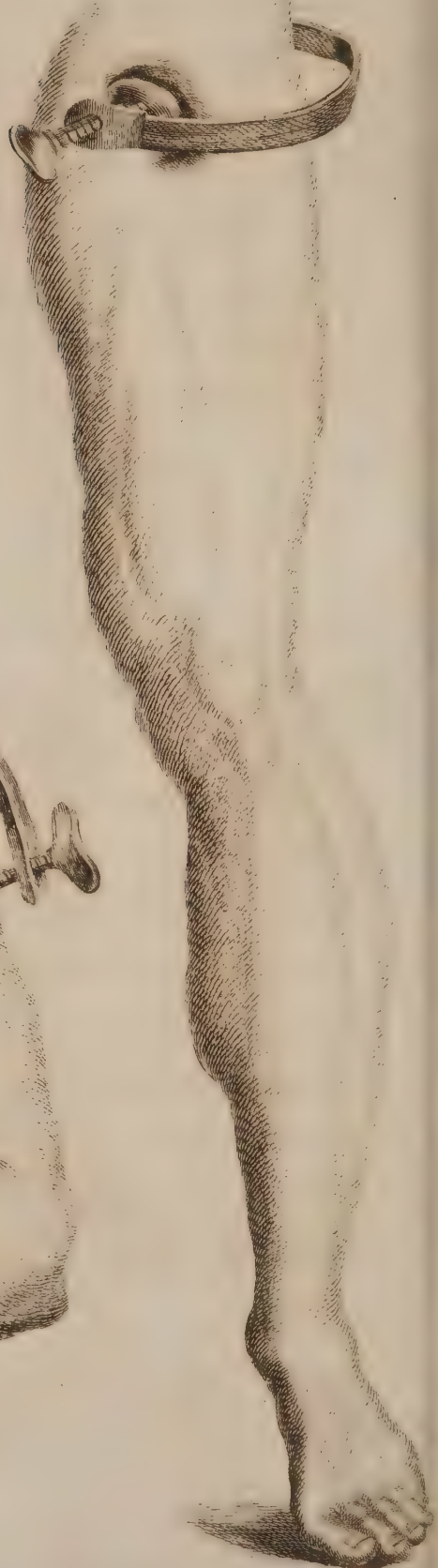
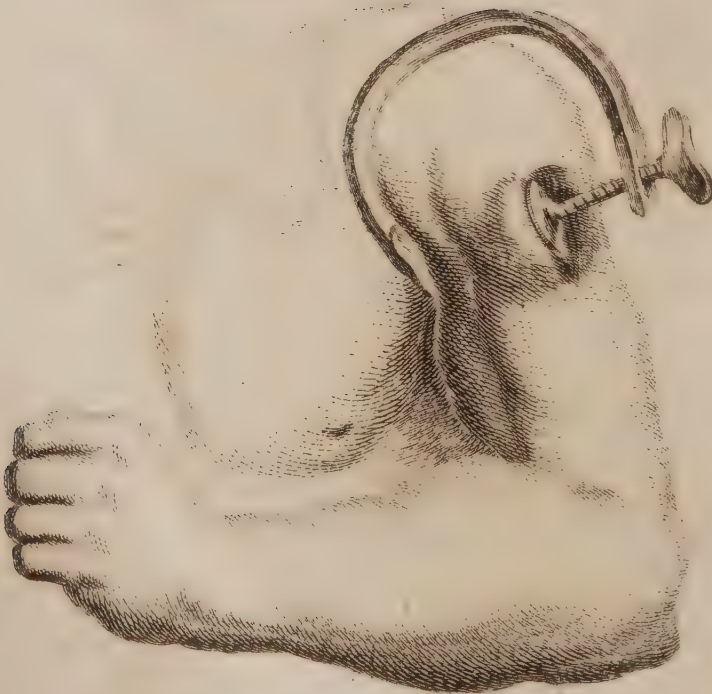


FIG. 3.



manner to moderate the febrile symptoms which commonly take place, it should never be omitted.

It has long been known, that the sensibility of any part may not only be lessened, but even altogether suspended, by compressing the nerves which supply it: And accordingly, in amputating limbs, patients frequently desire the tourniquet to be firmly screwed, from finding that it tends to diminish the pain of the operation.

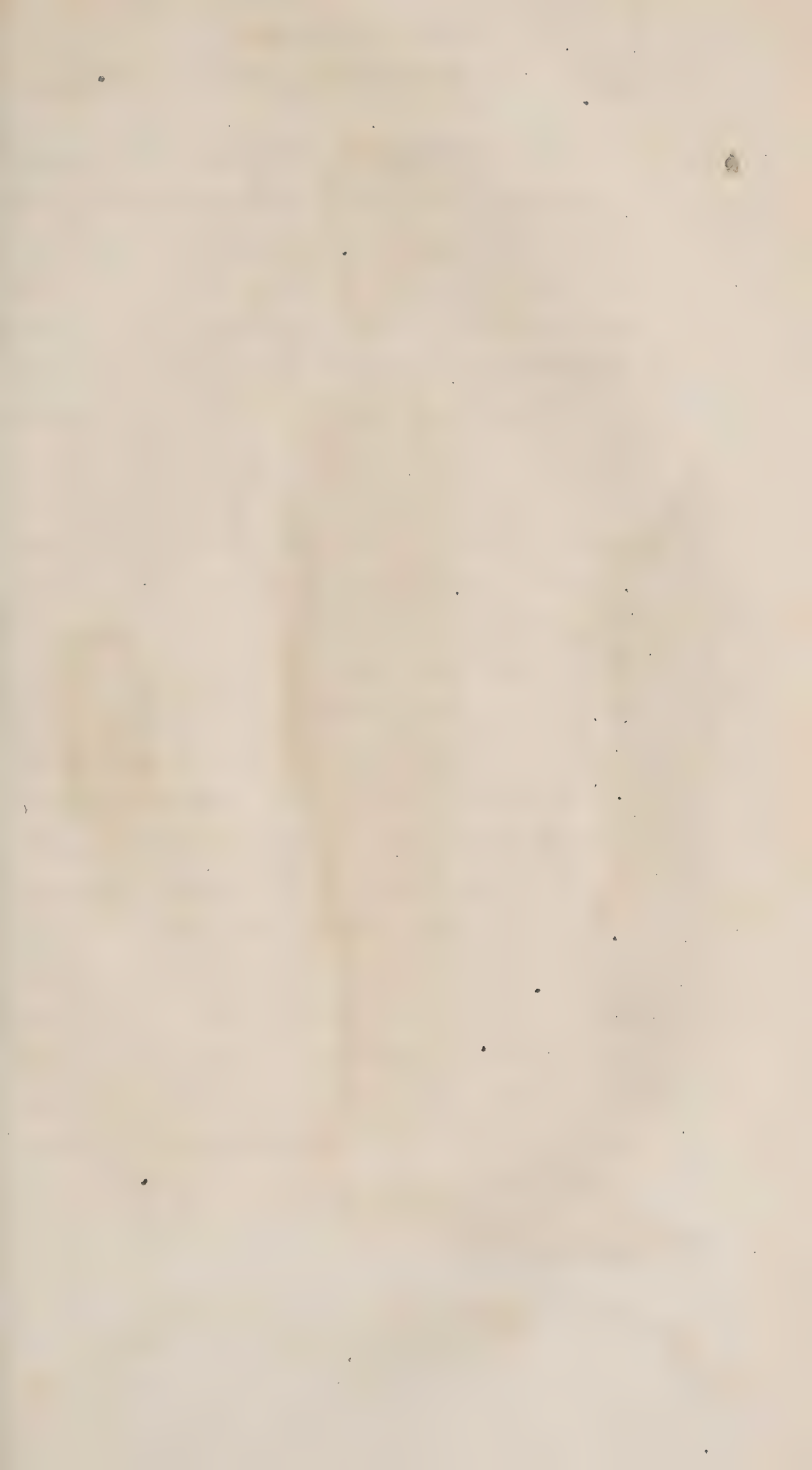
The effect of this, however, being inconsiderable, it has lately been proposed by Mr James Moore of London, to compress the principal nerves so completely as to render the parts beneath altogether insensible. In Plate LXXIII. an instrument is delineated, by which this may be very effectually done.

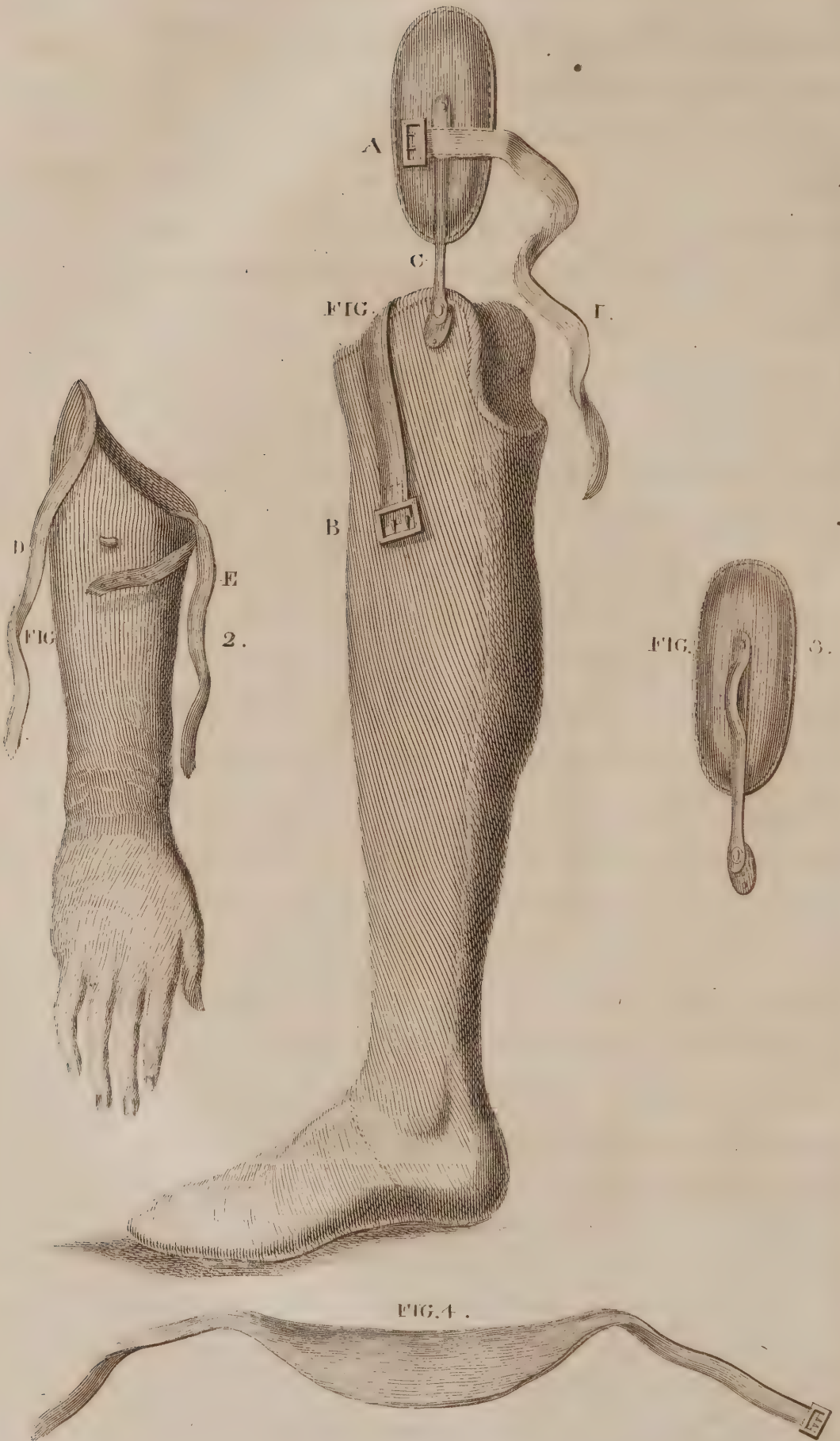
Whether or not it will answer with ease and certainty, experience alone must determine: But, in the mean time, we are much indebted to the ingenious author, for affording a hint which eventually

ally may tend to mitigate the sufferings of those whom necessity obliges to submit to chirurgical operations. All that this instrument seems to require in order to render it perfect, is the power of compressing the nerves of a limb without affecting the veins: for as it is found that the nerves must be compressed for a considerable time, at least an hour, before the parts beneath are rendered altogether insensible, the veins could not be compressed for such a length of time but with the risk of bursting. With a view to prevent such a disagreeable occurrence, Mr Moore proposes that one of the veins in the limb should be opened: But as this might prove hurtful to weakly patients, where it is often of importance to guard against the loss of blood, it would be better to avoid it, by having the instrument formed in such a manner, that it might compress the principal nerves only without materially affecting the veins. It will not indeed be easily done, as the nerves for the most part are at no

I : : : : great







great distance from the veins : But the same purpose may perhaps be answered by compressing the arteries which supply the limb for a minute or two before any pressure is applied to the veins ; by which the latter may be previously emptied.



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C H A P. XLVI.

*Of MIDWIFERY.*

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SECTION I.

*General Observations on Midwifery.*

**M**IDWIFERY being now considered as a distinct branch of practice, a minute account of it will not be expected in a System of Surgery. For more particular information, those authors who have wrote upon the subject may be consulted: but I have judged it proper to delineate the instruments usually employed in  
Midwifery

Midwifery; and to describe two operations, which although immediately connected with this branch, are yet more frequently performed by the surgeon than the accoucheur; namely, the Cæfarian operation, and the division of the symphysis pubis.

A great variety of instruments have been invented by practitioners in midwifery; almost every publication indeed upon this subject announces some invention of this kind. It is only those instruments, however, which experience has shown to be useful, that we mean to describe: these are not numerous; they are all delineated in Plates LXXXIX. XC. XCI. XCII. and XCIII. with the forceps in Plate LXXXIX. fig. 2. We lay hold of the head of the child when the mother is much enfeebled, and the contraction of the uterus not sufficient to expel the child in the usual way: And when delivery cannot be effected even in this manner, or by turning the child and bringing it away by the feet, as some-

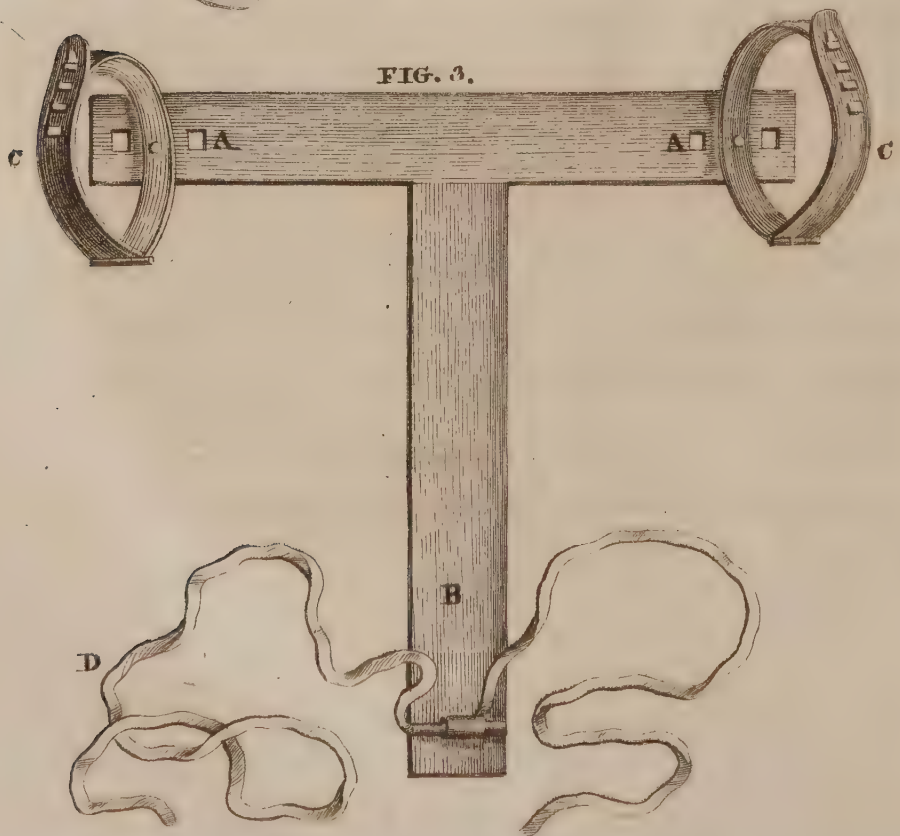
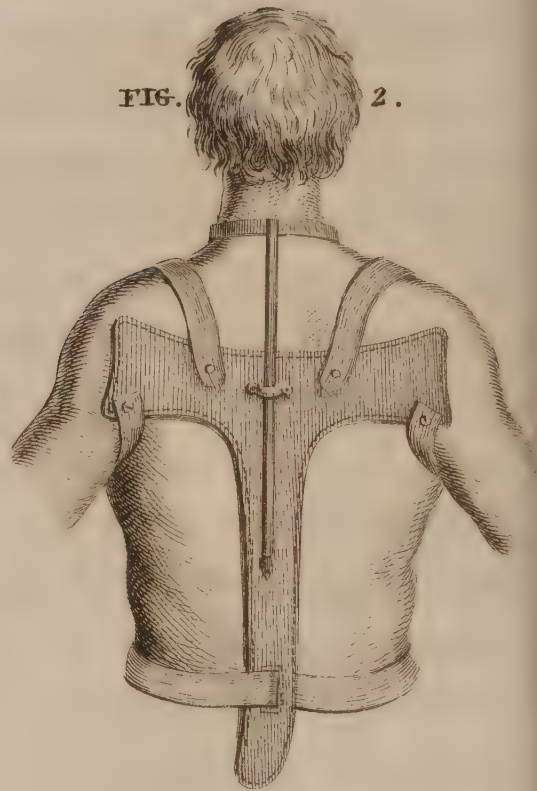
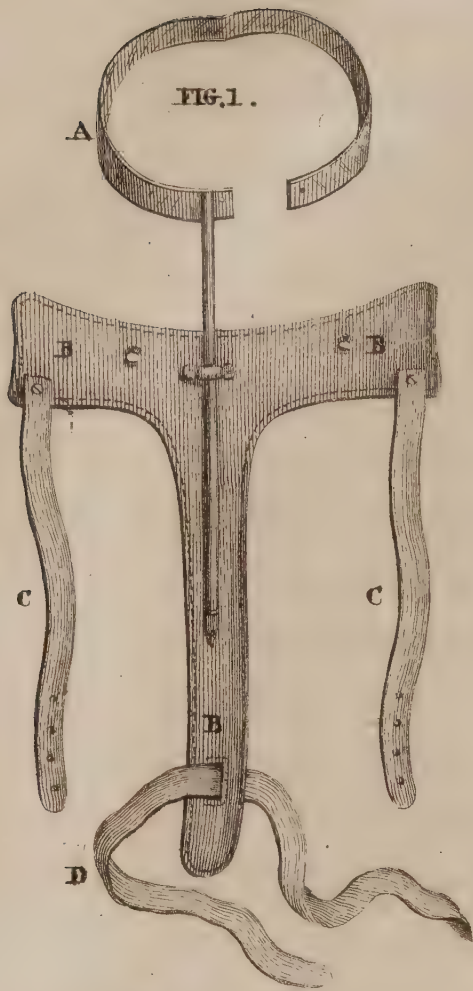
times happens from the pelvis being much distorted, we employ the crotchet represented in Plate XC. fig. 1. for bringing the child away piece-meal, after lessening the size of the head by an opening made in the skull for discharging the brain with the scissars represented in fig. 2. of the same Plate.

The necessity, however, of using any of these instruments I believe to be a rare occurrence: they are indeed frequently employed; but this proceeds in a great measure from impatience on the part of practitioners, who often force the delivery of the child, when Nature, if left to herself, would effect it in a much more easy manner. This fact is so certainly well-founded, and is of such general importance, that practitioners of every description, and more especially those who are newly entering on business, should never lose sight of it. By not meeting with that attention which it merits, both the forceps and crotchet are daily employed with too much freedom, to  
the





PLATE. LXXXVIII.



the disgrace of the art, and often with irreparable injury both to the mother and child.

In some cases it happens, that delivery cannot be effected even with the assistance of these instruments, owing to the brim of the pelvis being so narrow that it will not allow any part of the child to pass. In such circumstances, the Cæsa-rean Section, as it is termed, used formerly to be practised ; but the danger attending that operation being so great, that the mother was seldom saved by it, Mr Sigault of Paris, about ten years ago, proposed the division of the symphysis pubis, for the purpose of increasing the diameter of the pelvis, and for extracting the child in the usual way by the vagina.



## SECTION II.

*Of the Cæsarean Operation.*

**T**HIS operation may become necessary, as we have seen in the last Section, by the brim of the pelvis being so narrow that it will not allow the child to pass; and it may also become proper where the child has been forced into the cavity of the abdomen by a rupture in the uterus, as sometimes happens from the uterus contracting with too much force before the os tincæ is sufficiently dilated.

The Cæsarean section may be performed either with a view to save both the mother and child, when it is found that the child cannot be extracted in any other manner; to save the mother only when we know that the child is dead; or to  
save

save the child immediately after the death of the mother.

As there are few instances of the mother being saved by this operation, some have advised that it should never be performed till after the death of the mother. I am clearly of opinion that an operation attended with so much hazard should never be advised as long as there is the least reason to hope that delivery may be effected in any other manner: but I also think, that it is the duty of every practitioner to propose it when this cannot be accomplished; for it is surely better to afford the small chance to the mother which accrues from it, than to leave her to a certain prospect of death; while by the same means we may be enabled to save the child, which otherwise would be destroyed. None will hesitate in advising it after the death of the mother, when the child is found to be living. The following is the method of performing it.

The patient should be placed upon a

F f 4

table

table of the usual height, and laid upon her back, her hands and legs being properly secured by assistants; her head should be moderately elevated with pillows, and her thighs somewhat raised, in order to relax the abdominal muscles. The operator standing on one side of the table, is with a common round-edged scalpel to make an incision, six inches in length, through the skin and cellular substance, on one side of the abdomen: The cut should commence two inches above the umbilicus on the outer edge of the rectus muscle, and from thence should be carried in a perpendicular direction downwards. The uterus is now to be laid bare, by carrying the incision through the tendinous parts of the abdominal muscles and peritonæum; and this being done, an opening of the same length must be made in the uterus itself. The easiest method of effecting this is, to make a small opening with the scalpel sufficient to admit the finger, which serves as a conductor to a probe-pointed bistoury,



bistoury, with which the remaining part of the incision should be finished. I may also remark, that the bistoury inserted upon the finger, at an opening made for the purpose, is the best method of dividing the peritonæum and tendinous aponeurosis of the abdominal muscles.

If any large blood-vessel is cut in dividing either the external parts or the uterus, it should be immediately tied with a ligature of a sufficient length to hang out at the wound. The child must now be taken out; the placenta, and any effused blood that may have escaped during the operation, being also removed; and the intestines, if they have protruded, being replaced; the external opening should be secured with three or four futures, in the manner we have advised in Chapter. XXXVI. Sect. XII. § 3.

The wound being covered with a pledgit of any emollient ointment, the abdomen should be supported with several turns of a broad flannel roller; when the

x

patient

patient should be carried to bed, and strictly enjoined to avoid speaking and every kind of exertion.

Various causes concur to render this a very dangerous operation: Of these, the extensive exposure of the abdominal viscera, and hemorrhagies from the uterus, are the most material. Any protrusion, therefore, which occurs of the bowels should be immediately replaced, and no vessel of any importance that may be cut in the division of the uterus should be left untied: It is not advised by writers upon this subject, but I see no harm that can ensue from it. If the ligatures are applied with the tenaculum, they will soon separate; and by hanging out at the external wound, they may at any time be pulled away. It may be remarked, that it is internal hemorrhagies only that we have to dread, I mean such as occur from the vessels of the uterus: for, by carrying the incision on the outer edge of the rectus muscle, we avoid the epigastric artery; the only vessel of im-

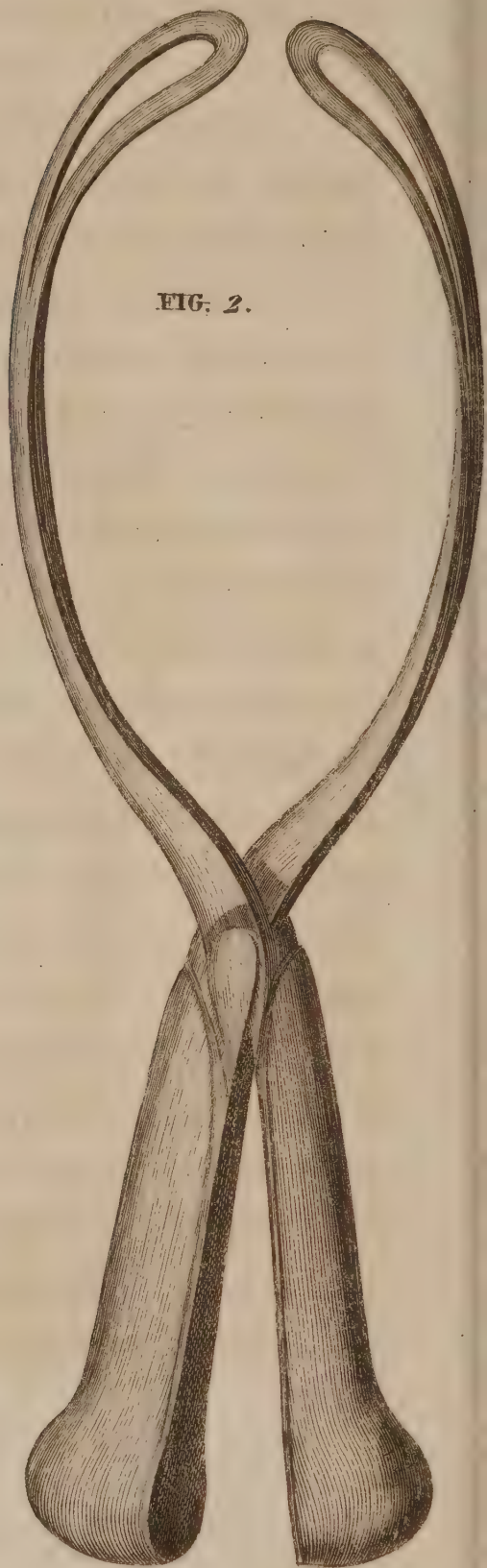




PLATE. LXXXIX.



1.



importance that runs any risk of being hurt in the division of the teguments and muscles.

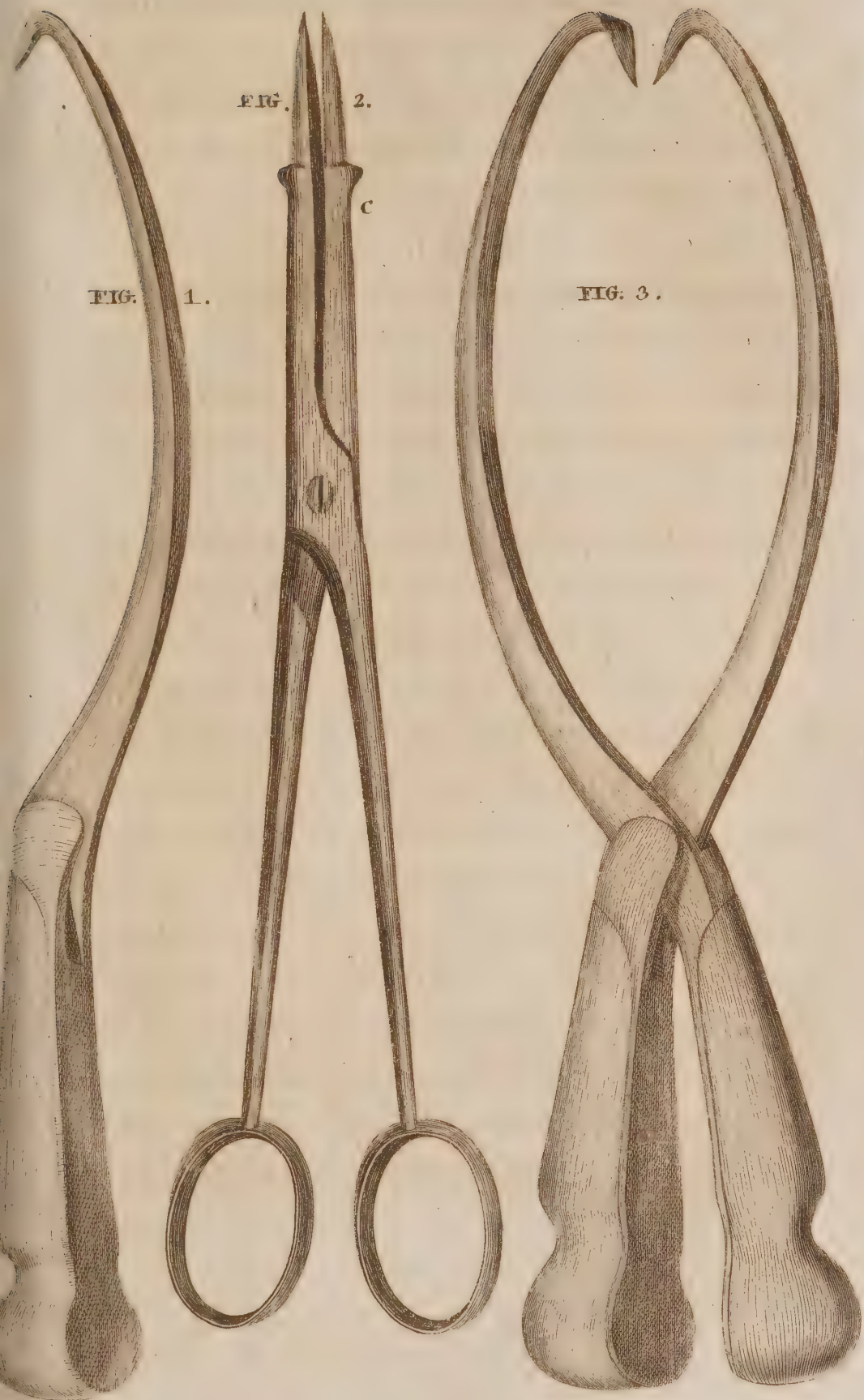
In order to avoid the risk of hemorrhagies from the uterus, some have advised the incision never to be made at that part where the placenta adheres; while, by others, we are directed to make the opening into the uterus exactly in a longitudinal direction, by which we are told that the principal vessels with which it is supplied will most readily be avoided. No advantage, however, is derived from this in practice: for the incision in the uterus must correspond exactly with the external incision; which cannot with propriety be made in any other direction than the one we have mentioned. Besides, it would often be impossible to distinguish the part at which the placenta adheres; nor is there much ground to suppose that the hemorrhagy from the uterus depends so much upon the direction as on the extent of the incision; and it ought not to be less than  
fix

fix inches in length, as the child could not be extracted with freedom at a ſmaller opening. It is ſcarcely neceſſary to remark, that the child and placenta ſhould be removed as ſoon after the incifion is made in the uterus as poſſible: It is thus allowed to contract, which it does inſtantly with great force; by which the hemorrhagy is more readily ſtopped than by any means we could employ for it.

By others, we are adviſed to leave a large opening at the under part of the external incifion, in order to give vent to any effuſion of blood that may happen. No advantage, however, is gained by this, as the incifion in the uterus, although oppoſite to the external opening at firſt, very ſoon falls beneath it when this viſcus contracts; by which any blood that is diſcharged falls into the bottom of the abdomen where it coagulates, and thus cannot be diſcharged at the wound. And as it is of importance to prevent the air as much as poſſible from finding acceſs



PLATE. XC.





acceſs to the abdomen, the external cut ſhould be quickly and entirely ſhut by as many futures as the length of it requires. The moſt effectual method with which I am acquainted of preventing hemorrhagies is, the tying of any large veſſels in the manner we have mentioned; keeping the patient cool and free from pain, by regulating the air of the apartment to a proper temperature, and adminiſtring opiates; and by preventing, as we have obſerved above, every kind of bodily exertion.

### SECTION III.

#### *Of the Division of the Symphyſis Pubis.*

**I**T has been long known, that the bones of the female pelvis are connected in ſuch a manner, that during the latter months of pregnancy, and eſpecially during



ring labour, they are separated in some degree from each other; by which the passage of the child is rendered much easier than it otherwise would be. It was a knowledge of this fact, and the great danger attending the Cæfarean operation, which first suggested the idea of dividing the bones of the pubis at their junction with each other in cases of narrow pelvis. It was proposed upwards of two hundred years ago, by a French surgeon of the name of Pineau; but Mr Sigault of Paris was the first who had the merit of putting it in practice, in the year 1777.

The operation is easily performed. The patient must be laid upon her back on a table of a convenient height; the pelvis should be elevated with two or three pillows put beneath it, and the legs and arms should be secured by assistants. When in this situation, the bladder should be emptied by the introduction of a catheter, which should be retained in the urethra by one of the assistants

till the division of the bones is completed.

After shaving the pubis, the operator, standing on one side of the patient, should with a longitudinal incision divide the skin and cellular substance covering the pubes at their symphysis: The cut should commence at the upper edge of these bones, and be continued nearly, but not entirely, along their whole breadth: On the bones being laid bare, the cartilage by which they are joined must be slowly and cautiously divided; and as it is by no means hard, it is easily done. Both the teguments and cartilage may be divided with a firm round-edged scalpel of the common form, which is the only instrument except the catheter that is necessary in this operation. The intention of the catheter is, to point out the course of the urethra to the operator; for it lies so contiguous to the pubes at their symphysis as to be in great danger of being cut, if this precaution be not attended to; even the  
bladder

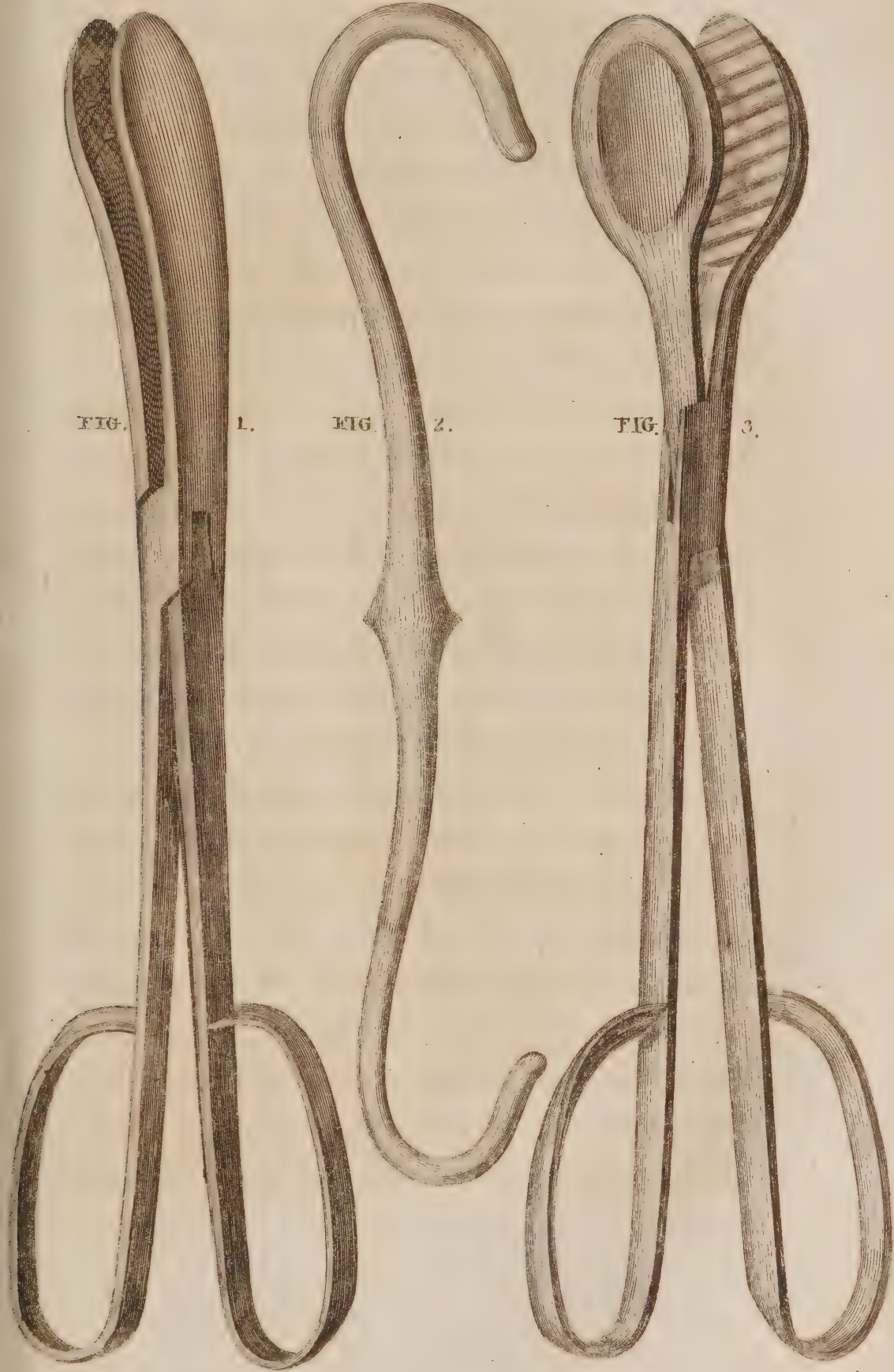
bladder itself might be injured, were the division of the cartilage not conducted with caution: but with due attention to these points, and avoiding the total division of the soft parts at the under edge of the bones, all risk of hurting either the bladder or urethra may be prevented.

On the division of the cartilage being completed, the bones recede considerably from each other. To prevent any consequences that might ensue from their separating forcibly and suddenly, the assistants who have the charge of the thighs should be desired to support them, particularly towards the end of the operation; and if a sufficient opening is not gained in this manner, the thighs may afterwards be slowly and gradually separated.

The child is now to be delivered in the usual way by the vagina; and this being affected, and the placenta removed, the bones should be immediately put together, and retained as exactly as possible



PLATE. XCI.





ble in their situation, by the proper application of a flannel or cotton roller round the pelvis and thighs; at the same time that the patient should be desired to remain as much as possible in one posture. The fore does not require any particular attention; in general it heals easily with light mild dressings; and for the most part the union of the bones is completed in the course of the fifth or sixth week. The patient, however, should not be allowed to walk, or to put the body into any posture that might effect an alteration in the situation of the bones, till nine or ten weeks have elapsed.

The only objection of importance that occurs to this operation is, the small space that is gained by it in that part of the pelvis where it is most required. By separating the ossa pubis at their symphysis, these bones do indeed recede to a considerable distance from each other; for the most part, the separation that takes place will be at least two inches in length: but this does not increase the



narrow diameter of the pelvis; that is, the bones of the pubis will still remain at nearly the same distance from the os sacrum as before the operation; and in almost every instance of difficult labour from mal-conformation of the pelvis, we find it proceeding entirely from the ossa pubis and os sacrum being too near to each other. It may often happen, however, that the head of the child may be so situated, that even this separation of the ossa pubis alone may allow it to pass, when otherwise it would have remained entirely above the brim of the pelvis; and as we do not find that the operation is in any respect hazardous, for in different instances it has been done more than once on the same person, it should always be advised, when we are convinced that the pelvis is so narrow that the child cannot possibly pass through it. It should always be advised in preference to the Cæfarean operation.

If farther experience shall show, that in all cases of narrow pelvis, the child  
may

may be delivered in this manner, it should even be preferred to the mode of delivering with the crotchet, which is undoubtedly one of the most barbarous operations in surgery; for while the very intention of it is to destroy the child, it often tears and mangles the mother so much that she never afterwards recovers from it.

## C H A P. XLVII.

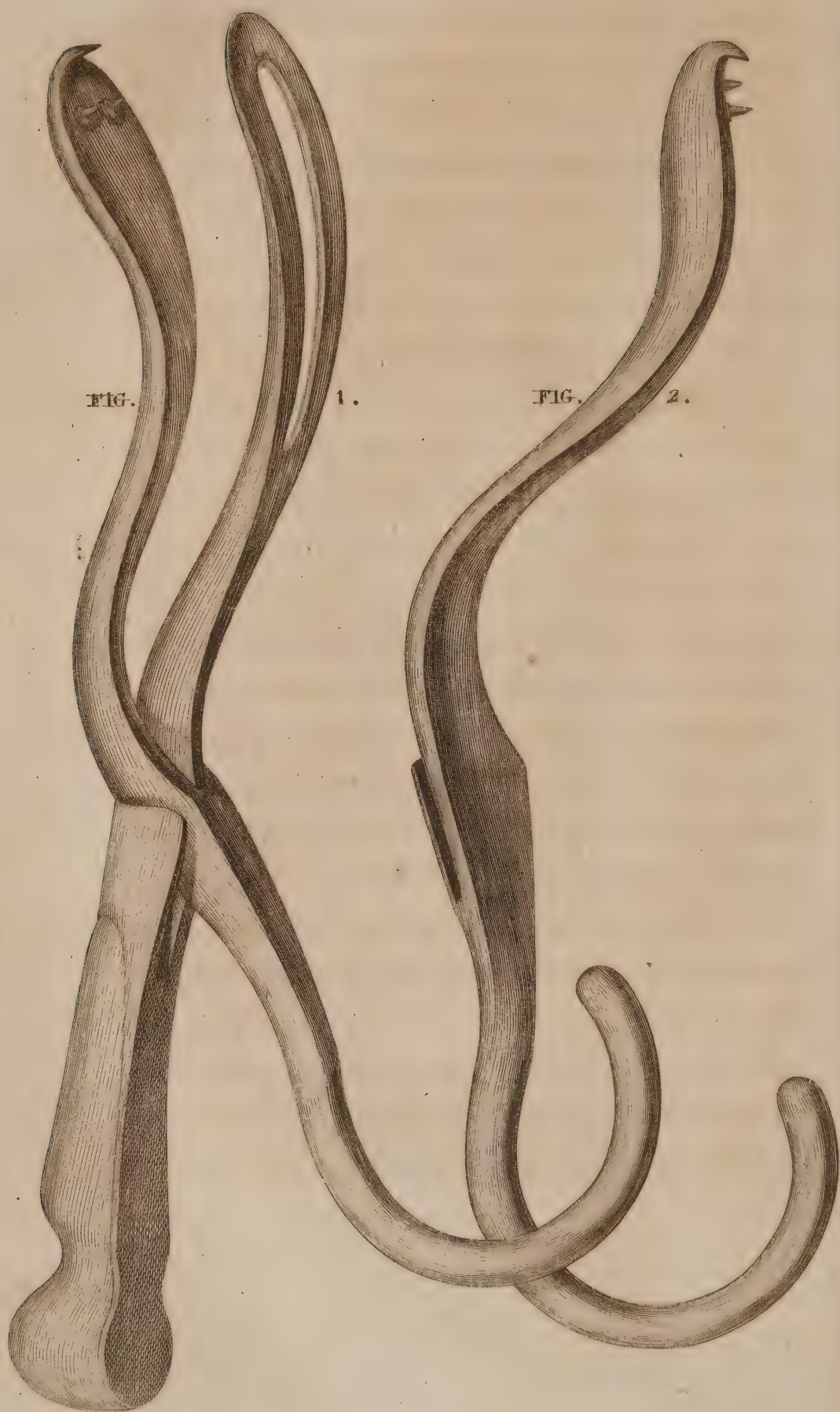
*Of* OPENING DEAD BODIES.

**W**ITH a view to discover the seat and causes of diseases, and at the instance of the civil magistrate in cases of violent death, surgeons are employed to open dead bodies. To do this with accuracy every preternatural appearance should be committed to paper. After noting any external marks of disease, we proceed to examine the state of the different cavities and of their contents. When the disorder has been seated in one cavity, we do not open the others; but  
when.





PLATE. XCII.



when they are all to be examined, it is proper to begin with the head.

The body being placed upon a table of a convenient height, and the head firmly fixed by an assistant, an incision should be made from ear to ear across the parietal bones. The scalp is now to be dissected from the parts beneath; and one half being turned backward and the other over the face, a common amputating saw must be used for dividing the cranium: The division may be begun on the os frontis immediately above the frontal sinuses, and must afterwards be continued backward through the parietal bones and os occipitis. The upper part of the skull is now to be raised with a levator; by this means the dura mater may be freely examined; and if we wish to go to the depth of the ventricles only, in order to discover whether any preternatural quantity of serum be collected in them, this may be done without removing the brain. But when our object is to examine the state of the



brain and cerebellum, they must both be removed and examined at leisure. This being done, and all the extravasated blood taken off with a sponge, the brain and cerebellum must be replaced with the skull-cap above them. The two portions of scalp are now to be drawn over the whole, and secured in their situation by sewing the edges of the cut together from one end to the other, either with the glover's stitch, or in any other way which the operator may prefer. For this purpose narrow tape is usually employed, and a large curved needle with a triangular point.

The cavities of the thorax and abdomen are most effectually exposed in the following manner: Let an incision be made through the common teguments from the top of the sternum to the umbilicus, and let it be continued on each side through the abdominal muscles, from the umbilicus to the top of the os ileum: The teguments and muscles must now be dissected from the thorax,  
till

PLATE. XCIII.

FIG. 1.

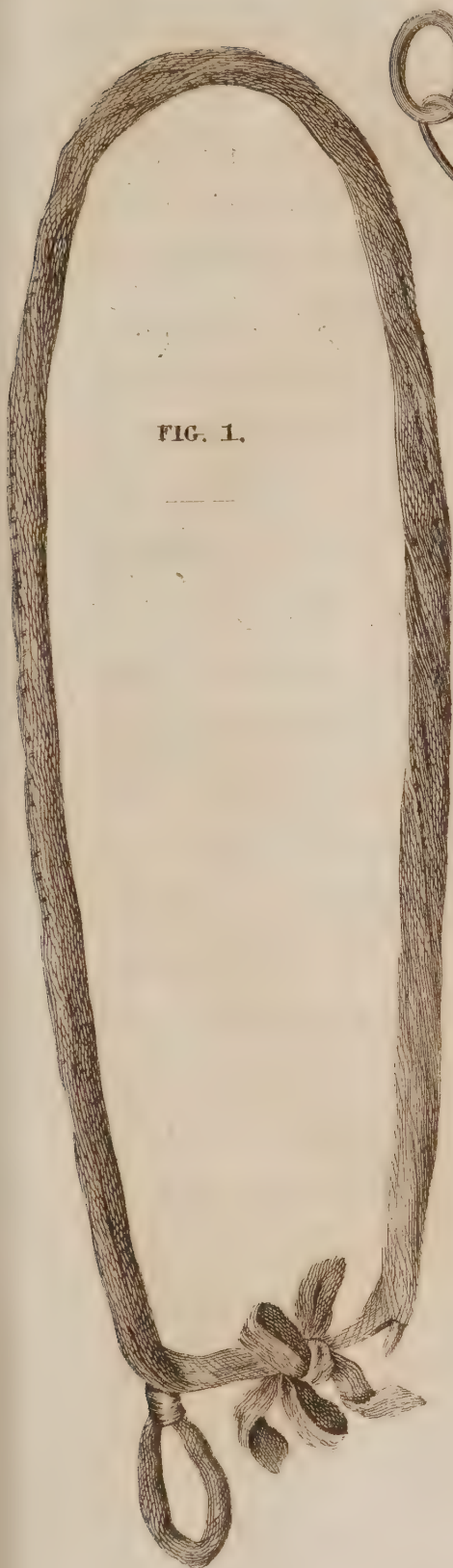


FIG.

2.



FIG.

3.







till all the cartilages which connect the sternum and ribs are freely laid bare; and being drawn backward, the cartilages must be divided with a strong knife as near as possible to the ribs; when the diaphragm being separated beneath, the under part of the sternum and cartilages connected with it, being raised and turned upward, the sternum must either be separated from the clavicles, or cut across near to the upper end of it. In this manner the contents of the thorax and abdomen are brought into view, when most of them may be examined without being removed; but when more accuracy is required than this admits of, the whole of them should be taken out: Or, when a partial examination is only required, that portion of them only may be removed which we mean to inspect.

To prevent the inconvenience resulting from the effusion of much blood and excrement, two strong ligatures should be passed at the distance of an inch from each other round the under part of the

alimentary canal and large contiguous blood-vessels, and round the trachea, œsophagus, and large blood-vessels of the neck. The parts between the upper and under ligatures being divided, the whole viscera of both the cavities may then be easily removed, by dissecting them from the contiguous parts, and raising them up as we go along.

The necessary examination being finished, the effused blood all washed off with a sponge, and the viscera replaced, the teguments must be drawn over them, and stitched together with as much neatness as possible.

In opening bodies that have died of any disease, the operator should be as cautious as possible in avoiding cuts or scratches of his fingers and hands: Various instances have occurred of much distress being induced; and in some cases even death has ensued, from inattention to this circumstance.

C H A P.

## C H A P. XLVIII.

*Of EMBALMING.*

**I**N former times, embalming was practised with more care and attention than it is now. This was a necessary consequence of the desire which then prevailed, of preserving dead bodies for ages. at present it is seldom employed, except for the purpose of preventing bodies from putrefying during the short space which elapses between the death and burial of the person ; and not even with this view, if the corps be not to be kept longer than is usually done in private life. The following is the present method of



embalming. The brain, and all the viscera of the thorax and abdomen, being removed in the manner we have mentioned, in the last Chapter, they are all, excepting the heart, put into a leaden box with a considerable quantity of an aromatic antiseptic powder, prepared with myrrh, frankincense, cloves, the leaves of lavender, rosemary, mint, sage, and other similar articles; and to these are added a proportion of any odoriferous oils. The blood being removed from the different cavities, and the heart replaced, they are all filled with the same kind of powder, with a due proportion of odoriferous oils or spirits, and the parts afterwards sowed up in the manner we have already advised. By some, too, the mouth and nostrils are stuffed with these powders and oils; and incisions are made into all the fleshy parts of the body, which are also stuffed with them, and afterwards sowed up: but there is no necessity for this, unless the body is to be kept for a great length of time, or to be carried to

a considerable distance. In which case, it is usual, after stuffing the incisions in the manner we have mentioned, to roll all the extremities, as well as the trunk of the body, firmly up with bandages, and to cover the whole with varnish.

The body is now to be laid upon a cerecloth of a sufficient size, which must be applied with as much neatness as possible to the head and every part of the body, and must either be firmly secured by sewing or with tapes tied at proper distances. The cerecloth is made of linen dipped in a composition of wax, oil, and rosin; which should be of such a consistence as to be sufficiently pliable, without being so soft as to stick to the fingers of those who apply it: It may be coloured with verdegris, red lead, or any other article according to the fancy of the operator. When two cerecloths are applied, one above another, they are usually made of different colours.

The cerecloth being put on, it was formerly the custom to employ a painter  
to

to colour the face ; but this is now very commonly omitted : the dress intended for the corps is immediately put on ; and the body is either laid in the coffin, or allowed to be exposed, according to circumstances.

C H A P.



## C H A P. XLIX.

*Of BANDAGES.*

**B**ANDAGES are employed for various purposes in Surgery ; for the retention of dressings ; for stopping hemorrhagies ; for removing deformities ; and for effecting the union of divided parts.

As a proper application of bandages is an object of much importance, it is a branch of the art which authors have not neglected : Many treatises have been published upon it ; but unfortunately it cannot be taught by description : Experience alone can give an adequate idea  
of

of it; nor is it possible to acquire it but by much manual practice. Hence, in the study of this part of surgery, more advantage is to be gained by practising upon a block, than by reading the most elaborate dissertations. My only intention, therefore, at present is, to offer a few general observations upon bandages.

I. Bandages should be formed of such materials as are sufficiently firm for effecting the purpose for which they are intended, at the same time that they may fit with ease upon the parts to which they are applied.

In some cases a degree of firmness is required, which cannot be obtained from materials of a soft texture: Of this we have examples in the most part of trusses for *Herniæ*, as well as in every bandage requiring much elasticity: But for the most part bandages are made of linen, cotton, or flannel. Till of late, linen was universally used for this purpose; but later

experience has shown, that cotton and flannel are preferable. They absorb moisture more readily, whether it be produced by sweat, or as the ordinary discharge of wounds or sores, at the same time that they are better calculated by their elasticity for yielding to the swelling which often takes place in luxations, fractures, and other injuries for which bandages are employed. Flannel was first used for this purpose in the Royal Infirmary here, about thirty years ago, by Mr James Rae of this place; and since that period the practice has been generally adopted. The objection made to the use of flannel for bandages, by some practitioners, of its not being so cleanly as linen, is frivolous: Neither of them will be cleanly if they be not frequently changed, while either of them will be sufficiently so if this point be attended to.

2. Bandages should be applied of a degree of tightness sufficient for answering



swering the purpose for which they are intended, without incurring any risk of their impeding the circulation, or doing harm in any other manner. No advantage will accrue from them if they be not sufficiently tight to support the parts affected; while swelling, inflammation, and even gangrene, will be apt to occur if they be too tightly applied.

3. Every bandage should be applied in such a manner, that it may be as easily loosened, and the parts examined with as much accuracy as possible. Thus in fractures of the thigh and leg, where the limb cannot with propriety be frequently raised, we now prefer universally the bandage with twelve or eighteen tails to the common roller. The former can be undone and fixed at pleasure without moving the limb, while a roller can neither be applied nor removed without raising every part of the limb to a considerable height.

4. Bandages should always be laid aside as soon as the purpose for which they



PLATE. XCIV.

FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

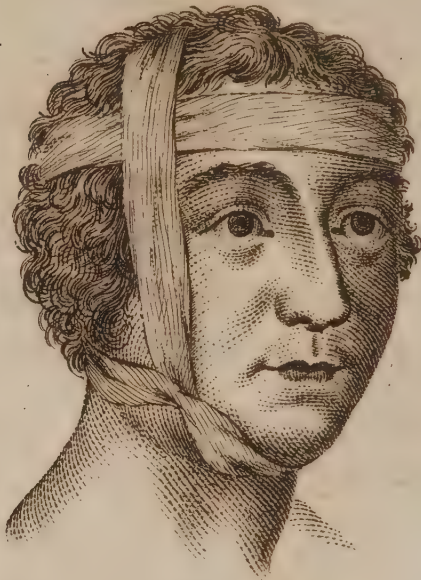


FIG.

5.



FIG.

6.





they are intended is accomplished. This being obtained, no advantage can accrue from them, and they often do harm by impeding the growth of the parts upon which they are applied.

5. We have found it necessary in the course of this work to mention bandages for many parts of the body. In speaking farther of bandages for particular parts, we shall begin with the head, and proceed downwards to the trunk of the body and extremities. One of the best bandages for all the upper and back parts of the head, for the fore-head, ears, and temples, is a night-cap, with one band to tie it before, and another beneath the chin, as is represented in Plate XCIV. fig. 1. The *Couvre-chef* of the French, represented in fig. 2. is most frequently used for these parts; but it can neither be applied with such firmness or neatness as the night-cap.

For the purpose of making compression on any particular part of the head,

VOL. VI.            H h            the

the Radiated Bandage, as it is termed, may be employed, as is represented in Plate XCIV. fig. 3. It may also be used for compressing the temporal artery : but for this purpose the machine represented in Plate VII. fig. 3. answers better.

In longitudinal cuts of the head, the Uniting Bandage, as it is termed, may be used with advantage. It is formed of a long roller with two heads, with a slit or opening in the middle, as is represented in Plate XCV. fig. 3. The sides of the cut being drawn neatly together, and covered with a pledgit of any simple ointment, the cure is to be effected by means of this bandage, applied in the manner represented in fig. 6. of the same Plate. In cuts of this description, their edges may sometimes be retained together with sufficient exactness by this bandage; and when this can be done, it will always be preferred to the mode of doing it by futures.

When it is necessary to retain dressings

fings upon the eyes, it has usually been done by placing a compress over them, and retaining it by several turns of a long roller, such as is represented in Plate XCV. fig. 1. This bandage, when employed for one eye, is the Monoculus of authors, and it is termed Binoculus when applied to both eyes. But as a roller passed round the head is apt to slip, even when applied in the most exact manner, the *couvre-chef* in Plate. XCIV. fig. 2. or the night-cap in the same Plate fig. 1. are by many preferred for retaining the compresses.

In fractures and cuts of the nose, the dressings are best retained by a proper application of the uniting bandage in Plate XCV. fig. 3. and a proper application of the same bandage answers best in longitudinal cuts of either of the lips.

In fractures of the lower jaw, we employ a four-headed roller, such as is represented in Plate XCV. fig. 4. The space left entire between the four-heads at A, is applied to the chin, the hole in the centre of it being meant to receive



the apex of the chin. The two superior heads are then carried backwards; and being made to pass each other at the occiput, they are afterwards brought forward over the os frontis: they may either be fixed there, or again reflected back and fixed with pins on the sides or back-parts of the head. The two under heads of the roller being reflected over the chin, are then to be turned upwards, and either tied or pinned on the top of the head; or before fixing them, they may be made to pass each other two or three times. Various other bandages are described by authors for the head; but those we have mentioned, with a proper application of the common roller, Plate XCV. fig. 1. for particular purposes, are all that can be ever required.

6. In Plate XXIII. fig. 1. an instrument is delineated for one of the most material operations upon the neck, Bronchotomy; and in Plate LXVI. fig. 1. another is represented for the wry neck;

A

# PLATE. XCV.

FIG. 1.



FIG. 2.



FIG. 3.

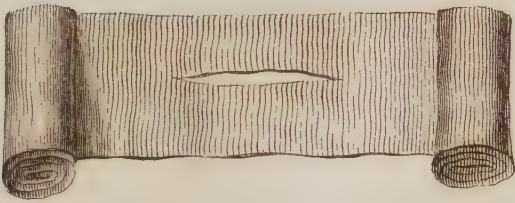


FIG. 4.

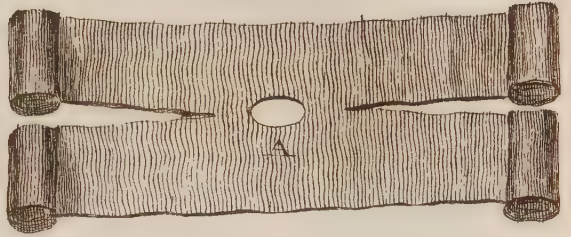


FIG.

5.

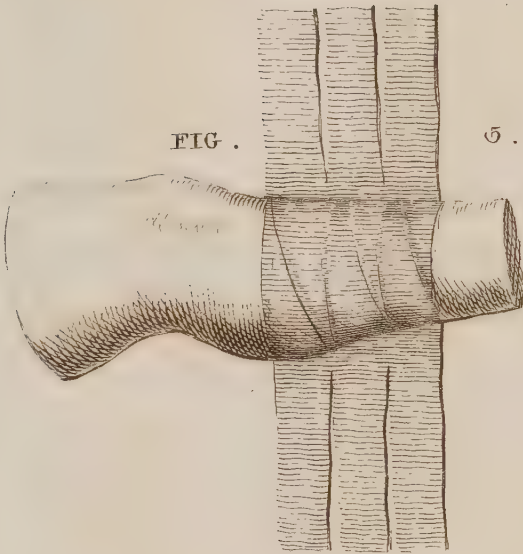


FIG.

6.

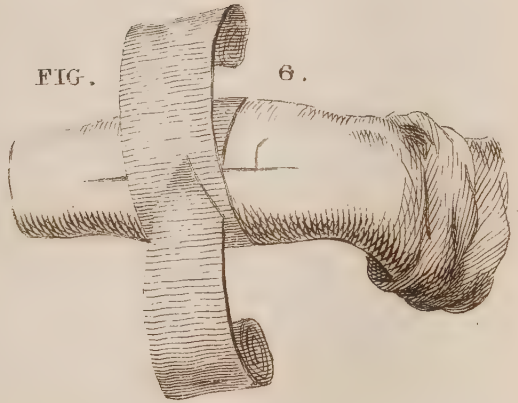


FIG. 7.

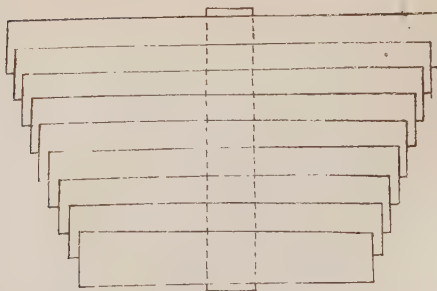






PLATE XCVI.

FIG.

1.

B

B

A

FIG.

2.

FIG.

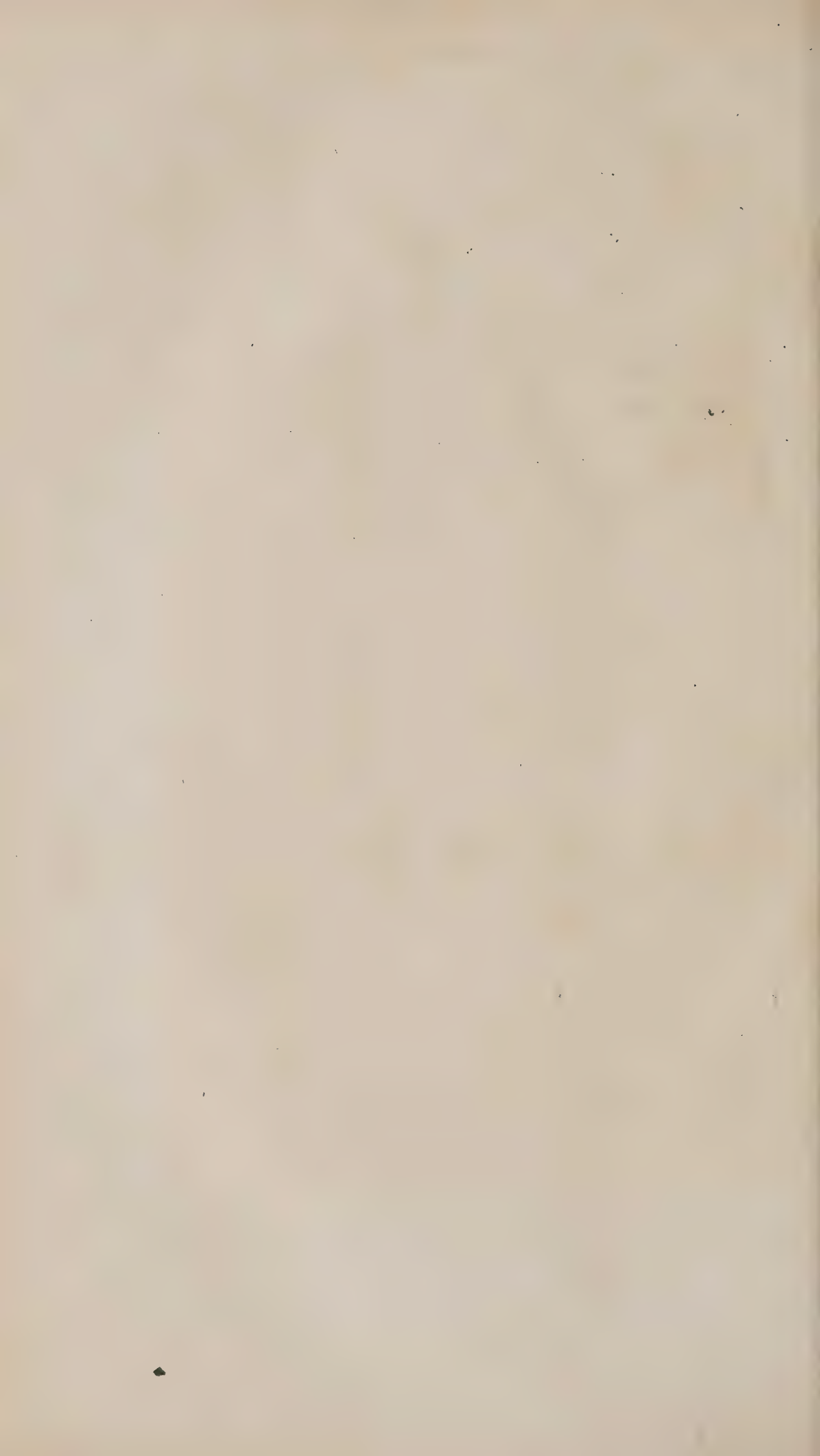
3.

C

FIG.

4.

D



A common roller may be made to answer every other purpose that can be required of a bandage in any part of the neck.

7. A variety of bandages are used for affections of the shoulders and contiguous parts, particularly for fractures of the scapula, and fractures and luxations of the clavicle. In fractures of the scapula, a proper application of a long roller may, in most instances, prove useful; but in Chapters XXXIX. Section V. we have shown, that no utility is derived from bandages in fractures of the clavicles: They cannot be applied with such tightness as to compress the fractured bone without impeding respiration; and besides, we do not find that they are necessary, when the arm of the affected side is properly supported by the sling, Plate LXXXI.

8. The most useful of all bandages for the thorax and abdomen, at least for the retention of dressings on any of those parts, is that which we usually term the

H h 3

Napkin



Napkin and Scapulary, represented in Plate XCVI. fig. 1. That part of it which goes round the body A, is termed the Napkin. When it is applied for making pressure upon a fractured rib, it should be in the form of a roller, and should pass two or three times round the body; when it is only used for retaining dressings, it should not go more than once round: It should be six or seven inches broad for an adult; and it should be secured by pieces of tape, tying it at each end instead of pins. The Scapulary BB, consists of a slip of linen, cotton, or flannel, about three inches broad, and of a length sufficient to reach from the upper part of the napkin behind, to pass over the shoulders and be pinned to it before: It is sometimes made with a hole in the centre of it for passing over the head; but it answers better to divide the anterior end of it by a longitudinal slit into two, and in applying it to make one of these slips pass on each side of the head.

This

This bandage answers the purpose better than any other for making pressure on the parts at which the viscera protrude, in cases of umbilical and ventral herniæ. As in such cases it is a point of much importance to have the bandage firmly fixed, we not only employ the scapulary for preventing it from slipping down, but a strap connected with it behind is passed between the thighs and pinned to it before to prevent it from slipping up.

In Plate XXII. fig. 2. a bandage is represented for compressing the abdomen in the operation of tapping; and in Plate VIII. different bandages are delineated, or Trusses as they are termed, for the retention of the protruded viscera in cases of herniæ.

9. As it is of much importance in various diseases, as well as in several operations, to have the scrotum properly supported, I have delineated some bandages for this purpose in Plate XCVII. The best bandage for the penis is a pouch, or bag of linen or cotton, to be fixed by

a roller, or two pieces of tape passed round the body.

The T-bandage, as it is commonly termed, Plate XCVI. figures. 3. and 4. is usually employed for the retention of dressings in affections of the anus and perineum, as well as in some disorders of the scrotum; but in the last, one or other of the suspensory bandages, represented in Plate. XCVII. will for the most part be found preferable.

10. In compound fractures of the arm, fore-arm, or hand, where motion of the limb would prove hurtful, the twelve or eighteen tailed bandage is equally proper as in similar affections of the lower extremities; but in simple fractures as well as in almost every other affection of these parts, we prefer a proper application of the roller.

11. We advised the uniting bandage for longitudinal cuts in the head; it answers equally well in wounds of a similar nature in every part of the extremities, as is represented in Plate XCV. fig. 6.

E X P L A-



PLATE.XCVII.

FIG. 1.

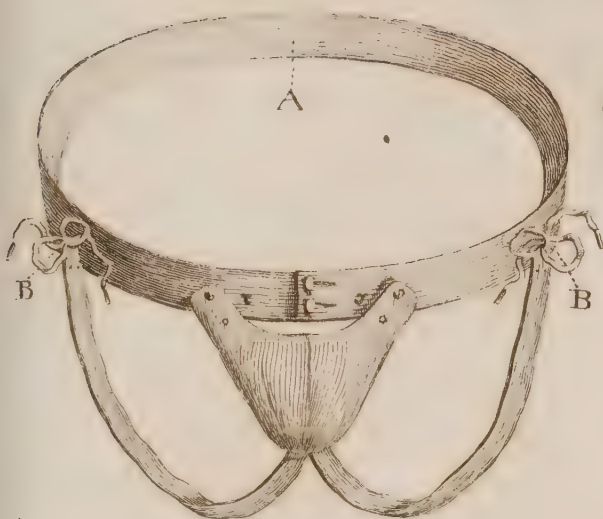


FIG. 2.

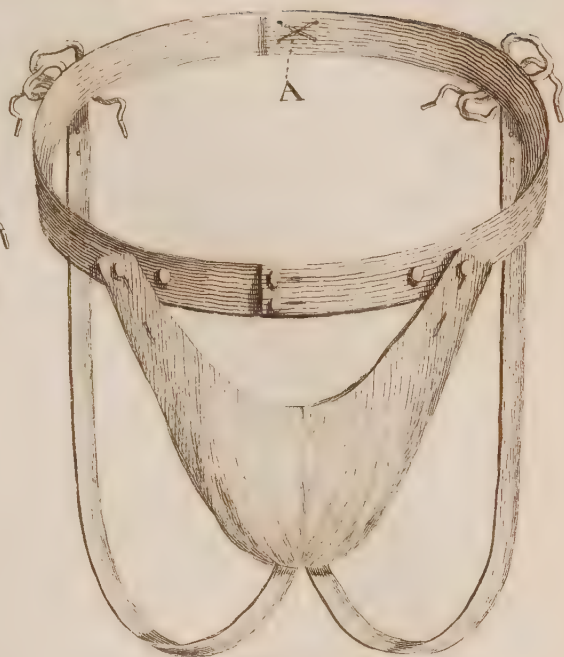


FIG. 3.

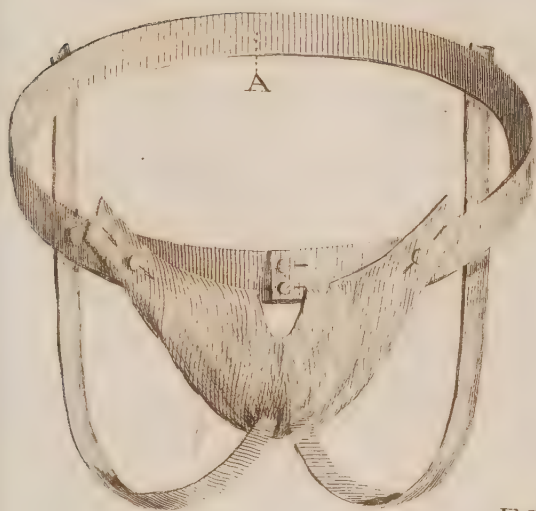


FIG. 4.

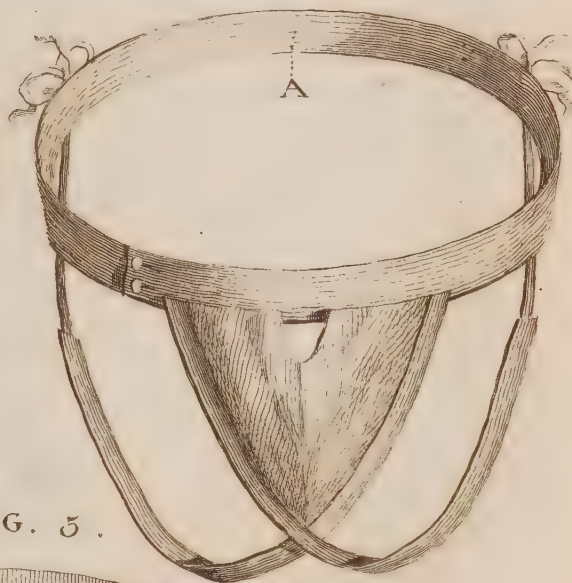
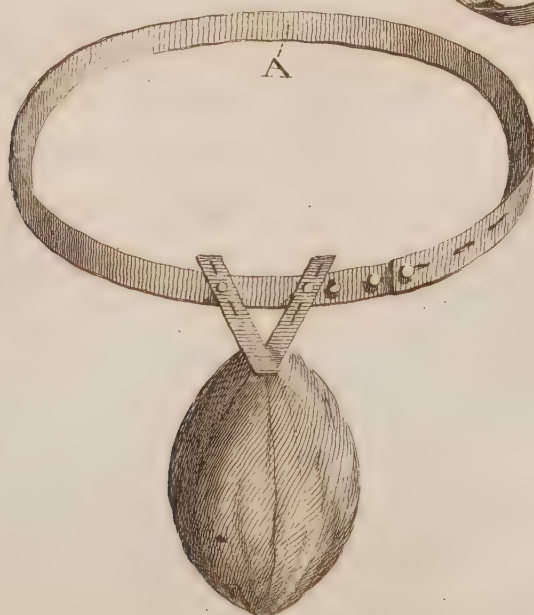


FIG. 5.





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EXPLANATION OF THE PLATES.

PLATE LXX.

[Opposite to page 86.]

Fig. 1. A splint of timber for a fractured leg, AA. Two loops for retaining leather straps, as represented in the front view of the same splint in fig. 2. CC. B, an opening for receiving the external maleolus when the leg is placed upon the outside.

Figures 3. 4. 5. and 6. are perhaps the best splints hitherto discovered for fractures of any of the extremities. They may be made of different forms, but one or other of these will answer almost for any purpose: They are made by glue-  
ing



ing a piece of thin timber, about the tenth part of an inch in thickness, upon leather. The timber is afterwards cut through to the leather, either with a fine saw or a knife set to a proper depth, in the manner represented in the figures.

These splints are preferable to those made of pasteboard; for while they are longitudinally perfectly firm, they are transversely sufficiently flexible for plying to the form of the limb. For the method of using them, we must refer to Sections *IX. X. XI. and XII.* of Chapter *XXXIX.*

Splints made in this manner have long been used by individuals; but Mr Gooch was the first who gave any description of them.

#### PLATE LXXI.

[Opposite to page 96].

As the splints used by Mr William Sharpe are still preferred by some practitioners, I have given a representation of them in this Plate.

These splints, figures 3. and 4. are  
formed

formed of strong pasteboard made with glue; they are fixed upon a fractured leg by three straps which surround the whole.

Fig. 4. Represents an under splint of an irregular form, suitable to that part of the leg it is meant to cover: It is a little convex externally, and concave internally. The length for a middle-sized man, eighteen inches from *E* to *E*; the width, two inches and three quarters at the strap near the knee, and two inches and a quarter at both the other straps.

*DFDFDF*, three leather straps from fifteen to twenty inches long, and one inch wide, having two rows of holes so placed, that every hole in each row may be opposite to a space in the other. These must be sowed fast to the middle and outside of the under splint. The portions of straps *DDD*, on the anterior part of the splint, must be shorter than those on the posterior, *FFF*, which are to surround the more muscular part of the leg.

*G,*

*G*, A part to support the foot from the point *E* to the heel *H*, five inches long at an angle of sixty degrees.

*C*, The foot strap, twelve inches long, sowed to the bottom of the under splint, within two inches of the point, to pass under the heel and through the leather loop *B* on the upper splint to the lowest pin *A*.

*I*, An irregular oval hole, two inches long, and almost one wide in the lowest part, but decreasing upwards to receive the maleolus externus or lower extremity of the fibula.

Fig. 2. Represents the leg raised up, to show the situation of the under splint when properly applied.

Fig. 3. The upper splint. *AAA*, The pins upon which the straps of the under splint are to be fixed by means of the holes *DDD*, *FFF*. *B*, the leather loop for receiving the foot-strap *C*, in fig. 4.

Fig. 1. Represents a fractured leg  
4 when



when laid within the splints, having the foot of a stocking and a shoe upon it.

## PLATE LXXII.

[Opposite to page 100.]

In this Plate I have delineated the instruments recommended by the late Mr Gooch, for preserving a fractured thigh and leg in a state of extension, as is mentioned more particularly in page, and which I shall describe in his own words.

Fig. 1. A machine for extending a fractured leg. The transom to which the sole is secured, is made to be opened and fixed by a pin; and the machine may occasionally be made wider, as appears by other holes in the transom; about which, on each side of the sole, fillets are to be tied, coming from a demity piece quilted for ease, and laced round the heel and instep, to make the extension upon the working of the screws; but buff leather may possibly answer better for protecting the parts even than demity.

Fig.

Fig. 2. Shows the machine, and one of the splints in Plate LXX, together upon the limb.

Fig. 3. The longitudinal parts of the machine for the thigh are designed to move upon the circular plates; by which means it may be accommodated to limbs of different sizes: and as there is a pin at each end of the circular plates, if the limb happens to be larger than ordinary straps of leather may be added.

Fig. 4. Shows the machine with the case upon the thigh.

Fig. 5. The key to work the screws. There should be two such keys, that the machine may occasionally be wrought on both sides at the same time.

### PLATE LXXIII.

[Opposite to page 109].

In page 109. we observed, that some improvements had been made by Dr Aitken upon Mr Gooche's instruments, represented in the preceding plate, for extending fractured limbs: In this plate I have given a representation of them.

I

Fig.

Fig. 1. Represents a machine for keeping the fragments of the thigh-bone *in situ* after setting, whether the fracture is simple or compound, on the neck or body of this bone. *AAA*, the upper circular which applies round the *pelvis*, like the top-band of a pair of breeches. It rests on the same parts, and is fixed or buttoned in the same manner, by the studs and corresponding holes, *H*.

*BB*, Two soft-stuffed straps fixed to the back-part of this circular, of such length as to pass between the thighs from behind forward, to tie round the fore-part of the same circular by means of their forked extremities *CC*. These effectually secure the circular from moving upward. There are two obscure joints *KK*, in the back-part of this circular, to facilitate its application; but it applies readily enough without them.

*DD*, The lower circular which fixes above the knee at the gartering place.

*EEE*, Three graduating steel splints  
which



which extend from the one circular to other: Their upper extremities are fixed to the upper circular by vertible flat-headed studs, fimilar to those at *FF*: their lower extremities pass through the iron screw plates *G*, firmly rivetted to the lower circular. The splints are provided with a number of impreffions or holes, in which the screw-nails which pass through the plates are fixed. By pushing the splints from below upward, the distance between the circulars is increased; and by turning the screw-nails it is maintained: consequently that part of the thigh included between the circulars can be kept extended at pleasure. The splints here are fixed for the right thigh; the pricked lines on the other side, show how they may be accommodated for the left one, or for both at the same time.

The largest circular *AAA*, consists of a piece of thick faddle-leather; all except its perforated part, and about a quarter of an inch on each edge, is covered  
on

on the inside with a flexible thin iron plate, such as is sometimes used by tin-plate workers: Over this it is lined with the softest buff, or shamoy leather, between which and the plate a thin layer of hair or wool is interposed: the lining ought to project on both sides half an inch or more, to prevent it in any degree from pressing on the skin.

The small circular *DD*, or inferior fixed point, is exactly similar to the large one in structure, the tin-plate excepted; which, on account of its smaller diameter, was found to be unnecessary.

The breadth of the upper circular, when extended for an adult, may be from three to four inches: That of the under circular should be in the same proportion.

The graduating steel splints, *EEE*, must be sufficiently long to extend from the upper circular to the lower, and to project over it about a hand-breadth: They require to be about four or five

eighth-parts of an inch broad, and about one eighth part of an inch thick.

Fig. 2. A machine constructed on the same principle with fig. 1. for the retention of a fractured leg.

*AA*, A circular, which applies below the knee-joint.

*BB*, Another, which fixes at the ankles.

*CCC*, The graduating splints similar to those of the thigh-machine, both in construction and action.

Fig. 3. A fracture-box mentioned in page 150. as the invention of Mr James Rae Surgeon of this place, improved by Mr John Rae his son.

*A*, The sole or base, which should be a firm deal at least an inch and half thick.

*BB*, the two ends which support the side beams *CCCC*. *DD*, Brass hinges, which admit of the ends folding down so as to render the machine more portable than it otherwise would be. *LL*, two parallel grooves for receiving two projecting parts of the corresponding end of



of the machine, by which the same instrument may be extended or shortened so as to fit any length of member. *EEEE*, Two lateral beams, which by the holes in their extremities will serve for any length to which the instrument may be extended: And by the pin at each end passing through them at the holes in the end beams, any one of the sides, or both of them, may be raised at pleasure.

*GGGG*, &c. Twelve or fourteen buckles on each side of the machine, with corresponding pieces of girth two inches broad, on which the member is supported by buckling them exactly to the form of the limb. *HI, HI*, Two straps, with corresponding buckles for fixing the base of the machine to the bed. The limb is fixed to the machine by two straps and buckles, one fixed at each end.

The advantages of this instrument are, that in compound fractures the sores can be inspected and dressed without deranging or moving any part of the limb,

by removing such of the straps as are necessary for bringing the sores into view. Instead of a twelve or eighteen tailed bandage of the common form, separate pieces of flannel should be used; so that such of those as are wet with the discharge can be easily moved without touching the rest.

In this manner the limb may be regularly dressed without being moved till the cure is completed, while the limb may be raised to any angle, by heightening one or other of the ends of the lateral beams by means of the holes and pins at each end.

#### PLATE LXXIV.

[Opposite to page 122.]

Fig. 1. A fractured limb dressed with an eighteen-tailed bandage, and laid upon the outside with the knee bent, in the manner recommended by Mr Pott.

Fig. 2. A fractured limb with an eighteen-tailed bandage, and one of the flexible splints in Plate LXX. There  
is

is also placed beneath the limb a firm unyielding splint, such as is represented in the same Plate, fig. 2.

PLATE LXXV.

[Opposite to page 129.]

Fig. 1. A machine mentioned in page 117. for retaining the different parts of a fractured patella.

*A*, A strap to be fixed by means of the buckle at one end on the upper part of the leg immediately below the knee. *B*, A similar strap to be fixed above the knee.

Fig. 2. A back view of the same machine. *F*, A femilunar compress of cork covered with shamoy leather, to be placed immediately above the upper part of the patella. *A*, A similar compress for supporting the inferior part of the bone.

These compresses being properly placed, they may be drawn to any degree of tightness by means of the straps and buckles *CDE*.

Fig. 3. A limb with a fractured patella,



la, and the bandage fig. 1. applied to it. In this figure the strap, *H*, is added to it: being fixed to the point of the shoe, and connected with one of the buckles above the knee, the limb is thereby kept extended; by which there is no risk of the fractured parts of the patella being forcibly pulled from each other, as would necessarily happen if the limb should be suddenly bent before the cure be completed.

#### PLATE LXXVI.

[Opposite to page 140].

Fig. 1. This represents the Ambe of Hippocrates, for the reduction of luxations of the humerus: it consists of a fulcrum and moveable lever. As it is still used by some practitioners, I judged it proper to mention it; but we have elsewhere had occasion to remark, that it is a dangerous instrument, and ought never to be employed. My reasons for thinking so are enumerated in Chapter XL. Section IX.

Fig.

Fig. 2. Mr Petit's instrument for reducing luxations of the humerus. *AA*, Two arms or horns, by which the scapula is kept firm during the extension. *BB*, The other end of the instrument resting upon the ground; *C*, the pulleys; *D*, ropes by winding up which with the handle *E* the limb may be slowly and gradually extended to any necessary degree.

Fig. 3. *AC*, an opening through which the arm is passed; *FF*, two apertures for receiving the ends *AA* of the instrument fig. 2. This being made of firm leather, the instrument is thereby prevented from fretting or galling the skin.

PLATE LXVII.

[Opposite to page 148].

Fig. 1. The Ambe of Hippocrates, represented by itself in the preceding Plate, is here applied and ready to be used.

Fig. 2. Pulleys for extending dislocated bones, as mentioned in page 231.

Fig. 3. This is a very useful part of the apparatus for extending dislocated limbs: It is formed of thick shamoy or buff leather. By tying it firmly round the limb with the broad straps at each end, a very considerable force may be applied by assistants pulling the ropes or straps passed over the hooks; it answers the purpose both more easily and more effectually than the common method of extending the limb with towels.

### PLATE LXXVIII.

[Opposite to page 236.]

In this Plate I have delineated one of the best instruments hitherto known for dislocations of the shoulders, when more than ordinary force is required. It is the invention of the late Mr Freke of London.

As instruments of this kind require to be very portable, Mr Freke has paid particular attention to this circumstance. The box, fig. 5. contains the whole apparatus;



paratus ; when shut, it is only one foot eight inches long, nine inches broad, and three inches and a quarter deep. Fig. 4. represents the instrument open, the two sides of the box being firmly fixed together by brass hinges at *C*, and with two hooks and eyes on the other side of the box. When one end of it is fixed on the ground, the other stands high enough to become a fulcrum or support for the lever *BB*, which is fixed on the roller *E* by a large wood screw, which turning sideways, as well as with the roller, it obtains a circumrotatory motion, so that it may serve to reduce a luxation either backward, forward, or downward.

The roller on which the lever is fixed is just the diameter of the depth of one of the boxes, into which are driven two iron pins, the ends of which are received by the two sides of the box, which are an inch thick.

The lever is two feet four inches long, and is cut and joined again by two hinges  
at

at *C*, to fold up so as to be contained in the box: on the backside of it is a hook to keep it strait; the other end of it is to hang over the roller an inch and a half, which is to be excavated and covered with buff-leather for the more easy reception of the head of the os humeri.

The iron roller *E* has two holes thro' it for receiving two cords from a brace fig. 3. fixed on the lower head of the os humeri, for on no other part of the arm above the cubit can a bandage for this purpose be useful; for if the surgeon applies it on the muscular part of the arm, it never fails slipping down to the joint before the limb can be extended.

The iron roller *E* has a square end, on which is fixed a wheel *D*, notched round, which works as a ratchet on a spring ketch under the lever; by which it is stopped as it is wound up with a winch, so that at pleasure it may be let loose by discharging the ketch.

The brace, fig. 3. consists of a large  
piece

piece of buff-leather large enough to embrace the arm, sowed on two pieces of strong iron curved plates rivetted together, one of them having an eye at each end to fasten two cords in; the other is bent at the ends into two hooks, which are to receive the cords after they have crossed the arm above.

In order to keep the patient steady in his chair, and to prevent the scapula from rising on depressing the lever, after the limb is drawn forward by the winch, there must be fixed over the shoulder a girth with two hooks at the end of it, as is represented in fig. 2. The girth should be long enough to reach the ground on the other side, where it must be hooked into the ring *B*, screwed into the floor for that purpose, as in fig. 1.

PLATE LXXIX.

[Opposite to page 248]. 298.

In this Plate I have delineated an instrument mentioned in Chapter XLI, for  
the



the purpose of removing contractions of the ham-strings or flexor tendons of the leg.

Fig. 1. A front view of the instrument: *AA*, two curved steel plates connected together by a firm steel splint *D*, in fig. 2. One of these is to be applied to the back part of the thigh, and the other to the upper and back part of the leg; while by means of the leather straps *EE*, such a degree of pressure is made as the patient is able to bear.

*BB*, fig. 1. Is a soft cushion of quilted cotton for surrounding the limb to prevent the leather straps from fretting it. The curved plates *AA* should for the same purpose be lined with shamoy.

Fig. 2. A back view of the same instrument.

Fig. 3. A limb with the instrument applied on it.

## PLATE LXXX.

[Opposite to page 260.]

I have here delineated a fracture box,  
mentioned

mentioned in page 126. It is formed upon the same principle, but somewhat more simple in the construction than Mr Rae's in Plate LXXIII. fig. 3.

Fig. 1. *AA*, The base or bottom of the instrument, formed of deal an inch and half thick. *BB*, Two ends rising from the base, and terminating in the pillars *CCCC*. *DD*, An excavated moveable piece of timber for supporting the fractured limb. This moveable part of the instrument may be raised and supported at any height by the pins *EE* passing through the holes in the pillars *CCCC*; and it may at pleasure be raised at one end and depressed at the other.

*HH*, Two straps connected with buckles on the opposite side for fixing the limb after it is properly placed. Before laying down the leg, the dressings should be all applied, and the excavated part of the instrument should be completely lined with soft wool. *G*, A hole for receiving the heel to prevent it from  
being

being hurt when the leg is stretched out, as represented in fig.

The ends, *BB*, may either be fixed to the base of the instrument, or, in order to render it more portable, they may be made moveable, and fixed for use by a double pin at each end *F*.

### PLATE LXXXI.

[Opposite to page 277.]

In Chapter XXXIX. Section V. as well as in other parts of this work, we had occasion to recommend an instrument for supporting the fore-arm as being preferable to any bandage. A representation is given of it in fig. 1.

*AA*, a case or frame of firm leather properly lined with flannel and wool, of a sufficient length for covering the arm from the elbow to the point of the fingers. This is intended for the left arm. *B*, A collar of soft buff leather for passing over the right arm, in order to support the fore-part of the case by the strap *F* passing over the left shoulder, to be fixed to



a buckle at *C*, to prevent the collar *B* from flipping down. *GH*, Two straps and buckles for fixing the arm down to the instrument.

The application of this instrument will be better understood by the view of it in fig. 2.

I was favoured with this instrument by Dr Monro, to whom, I believe, it was sent by Mr Park of Liverpool.

Figures 3. and 4. Two artificial legs, delineated by Mr White of Manchester in his *Cases in Surgery*. Fig. 4. *AA*, A hollow leg made of tin, and covered with thin leather. *B*, A leather strap with a buckle on the outside, for fixing it below the knee. *CD*, Longitudinal steel bars, to be made as tough and light as possible, with sufficient strength. These bars are joined by a moveable joint, to be placed exactly opposite to the knee-joint. *E*, A steel bow made thin and elastic, to pass about two thirds round the lower part of the thigh, and fixed with straps of leather to buckle on the fore-part.

Fig. 3. Another artificial leg made in  
the

the same manner with fig. 4. with the addition of a foot made of light wood and moveable joints, so as to imitate pretty nearly the natural motions of the joints of the ankle and toes.

## P L A T E. LXXXII.

[Opposite to page 293.]

Fig. 1. A machine invented by an ingenious tradesman of this place, Mr Gavin Wilson, for distortions of the leg. This subject was treated of in Chapter XLI. *AA*, A case of firm leather open before, for receiving the distorted leg and foot. *BC*, A splint of iron for giving an additional firmness. The leg being placed in this case, the foot is fixed down to the bottom or sole of it by the strap *H* passed through the hole *I*; and the leg itself is gradually drawn either to one side or another according to the nature of the distortion, and secured by a proper application of the straps *DE*, to be fixed upon the brass hooks *GE*. By a due perseverance in the use of this ma-

chine, many bad cases of distorted limbs have been completely cured.

Fig. 3. A pair of shoes which have proved serviceable in some cases of distortions of the ankle-joint, where the toes have been turned too much inward. As they are light they may be used even in early infancy. After the feet are fixed in the shoes by the laces before, the toes may be separated to a proper distance, and preserved in this situation by the apparatus at *A*; which consists of three small iron plates, more particularly delineated in fig. 5. and at *B*, fig. 4. Fig. 5. consists of two parallel thin plates, fixed with nails to the outside of the sole of one shoe; and they are so far separated from each other, as to receive the round plate *B* between them, the end of which is fixed to the sole of the other shoe. The three plates are connected together by a nail passing through the hole in the centre of each. This admits of a considerable degree of motion, by which the toes may be moved either outward or inward; but they can be easily fixed at any particular



point by a small iron pin *A* passed thro' one or other of the holes in the side of the plates *B*.

PLATE. LXXXIII.

[Opposite to page 296.]

In this Plate I have delineated an apparatus mentioned in Chapter XLI. for distortions of the legs.

Fig. 1. *AB*, An iron splint properly covered with soft leather fixed in an iron frame *C*. The splint may be made to fix on either side of the frame according to the nature of the curvature. In a distorted leg the foot is to be fixed down to the frame *C* by means of the shoe represented in figure 3. This is easiest done by passing a nail through the heel of the shoe into the frame upon which the shoe may move. If the leg is bent outward, the splint *AB*, fig. 1. is placed on the inside, and it should be of such a length that the pad *B* may rest upon the internal condyle of the knee joint, where it should be fixed by the strap *E*. When the bones are

bent inward, the splint must be placed on the outside of the leg.

The straps *EF* must be passed two or three times round the convex part of the leg, and should be made to press it with some degree of force toward the splint; and by increasing the pressure from time to time, the convexity or curvature will be gradually lessened till at last it may in many instances be totally removed. By means of the strap *C*, the toes are to be drawn from that side to which they incline, and fixed to the opposite side of the frame. The screw-nail *D* determines what is gained from time to time, by moving it from one hole in the frame to another.

Fig. 4. A machine invented by the late Mr Gooch, for giving support to weak limbs as well as for removing distortions. *AAA*, Three steel-bows made thin and very elastic: They must stand clear of the tibia; must pass about half round the limb, and be fixed with straps of leather upon round-headed pins.

K k 2

*BBB*,

*BBB*, A longitudinal plate, to be made of tough stuff, as the workmen term it, and as light as possible with sufficient strength.

*C*, The shank to pass into the socket, in that part of the machine which is to be fixed into the heel of the shoe or laced boot, and confined there by a screw at the bottom.

*D*, The screw to keep the shank in the socket.

#### PLATE LXXXIV

[Opposite to page 339].

Fig. 1. A small spring saw used in amputating the fingers and toes.

Fig. 2. and 3. Retractors made of thin iron plates for drawing up and supporting the muscles and other soft parts in amputating limbs while the saw is applied to the bones. They should be kept with openings of different sizes, so as to answer where the bone is large or small, or whether there be two bones or only one.

Fig. 4.



Fig. 4. A piece of firm slit leather, which answers the purpose of a retractor extremely well. It is better suited for this than a bit of linen, which is generally used, but which does not support the parts with sufficient firmness.

## PLATE LXXXV.

[Opposite to page 341].

Fig. 1. The saw I always use in the amputation of legs and arms: It should be seventeen inches in length, including the handle, and two inches and a quarter in breadth at its broadest part.

Fig. 2. A small double-edged knife, commonly termed a Catline, for the purpose of dividing the interosseous ligaments and other soft parts in amputating the leg and fore-arm: It should be nine inches long.

Fig. 3. An amputating knife, which answers either for the thigh, leg, or arm: It should be thirteen inches in length.

Fig. 4. A small crooked knife for separating the muscles from the bone, in

the manner I have advised in the Chapter on Amputation, Section IV.

PLATE LXXXVI.

[Opposite to page 439].

In Chapter XLV. I gave some account of an ingenious proposal by Mr Moore of London for diminishing and preventing pain in several operations of surgery. It is done by compressing the nerves of the limb upon which an operation is to be performed. In this Plate I have represented the apparatus recommended by Mr Moore for this purpose.

Fig. 1. *A*, The compressing instrument, being formed of a curved piece of iron covered with leather, and of sufficient capacity to contain the thigh within its curve.

*B*, A firm compress of leather at one extremity of the instrument, to be placed on the sciatic nerve.

*D*, An oval compress fixed on a screw, passing through a hole at the other extremity

tremity of the instrument. This compress to be placed on the crural nerve.

When this instrument is to be used, it will be necessary in the first place to search for the sciatic nerve: For this purpose let the operator feel for the tuberosity of the ischium, and then for the great trochanter; and supposing a straight line drawn from the one to the other, apply the compress *B* about an inch above the middle of that line.

The crural nerve is found by the pulsation of the crural artery, which runs contiguous to it; the oval compress *D* must next be applied above it; and upon turning the screw connected with it, the sciatic nerve is pressed by *B* against the edge of the sciatic notch, and the crural nerve against the os femoris to any degree that is necessary.

Fig. 2. Represents the instrument adjusted to the thigh; and fig. 3. a smaller compressor suited to the arm.



## PLATE LXXXVII.

[Opposite to page 441].

In this Plate I have given a representation of an artificial leg and arm made by a very ingenious artist of this place, who I have in different parts of this Work had occasion to speak of, Mr Gavin Wilfon.

Fig. 1. An artificial leg made of firm hardened leather.

*A*, An oval piece of the same kind of leather lined with shamoy, fixed upon a plate of iron *C*, and moving upon an axis at the knee. The strap *I*, with the buckle connected with it, serves to fix it to the thigh. There must also be an oval piece connected with a similar iron plate on the opposite side of the thigh: These iron plates and oval pads should together go about nine inches up the thigh.

*B*, A strap that comes from the sole of the foot, and goes up on the inside of the leg to the middle of the thigh, where it  
is

is fixed by a buckle to a strap coming from the opposite shoulder: This serves to support the leg, and to take the weight of it more effectually from the weak side than any invention I have met with.

Fig. 3. The oval piece of leather and iron splint to which it is fixed.

Fig. 4. A piece of soft shamoy leather which fixes by a buckle and strap round the condyles at the knee. In legs of this kind, the persons weight rests upon the condyles and patella, the stump itself hanging quite free within the leg. This band or strap serves in the most effectual manner to prevent pain and excoriation, which otherwise would probably ensue from the friction of the leg against the knee.

Fig. 2. A fore-arm and hand made of the same kind of leather, and made to fix to the arm and shoulder by the straps *DE*.

These artificial legs and arms are preferable to any I have ever seen. The leg, when properly fitted, proves equally  
useful

useful with the common timber leg, and it is preferable, from being neater; at the same time, that it is not liable to break, an accident to which the others are very liable: and it answers better than a leg made of copper, from being considerably lighter, and not apt to be hurt in its shape by bruises.

Mr Wilson makes three different kinds of legs corresponding to the part at which the limb is amputated. In amputating the leg lower than the usual part, that is, in such a manner that the motion of the knee is to be retained, it answers better at the distance of nine or ten inches from the condyles of the knee than either higher or lower. When higher, the remaining part of the leg is not sufficient to support the artificial leg in walking; and when much lower, it renders it necessary to make the machine thicker about the ankle than would otherwise be required, by which it is rendered clumsy and heavier. Fig. 1. in this Plate represents a leg for this part.

The second kind of artificial leg made  
by



by Mr Wilson is intended for those cases where the amputation has been performed at the usual place below the knee, where the weight of the body rests upon the knee-joint and upper part of the leg upon a soft stuffed cushion.

These legs have no flexion at the knee, and the hollow for receiving the thigh goes up near to the hip: It opens behind to admit the thigh; it is fixed with three straps and hooks, which last are not only stronger, but less bulky than buckles.

When a limb is amputated above the knee, a joint is formed in the artificial leg at the knee. In walking, the limb is made steady by a steel bolt running in two staples on the outside of the thigh being pushed down; and when the patient sits down, he renders the joint flexible by pulling the bolt up. This is easily done, and it adds much to the utility of the invention.

The rest or support in this leg is obtained in part from its embracing the upper  
part

part of the thigh tightly, but chiefly from the back part of the thigh box-being stuffed in such a manner that the lower part of the hip rests upon it with nearly the same ease that one does in sitting on a stuffed chair; and in fact, a person sits on it when he either stands or walks; by which, and by the strap carried up from the sole of the foot to the shoulder, the limb is very easily carried about.

Mr Wilson's artificial arms, besides being made of firm hardened leather, are covered with white lambskin, so tinged as very nearly to resemble the human skin. The nails are made of white horn, tinged in such a manner as to be a very near imitation of nature.

The wrist-joint is a ball and socket, and answers all the purposes of flexion, extension, and rotation. The first joints of the thumb and fingers are also balls and sockets made of hammered plate-brass, and all the balls are hollow to diminish their weight. The second and third joints are somewhat similar to that which anatomists

mists term *Ginglimus*, but they are so far different as to admit of any motion, whether flexion, extension, or lateral.

The fingers and metacarpus are made up to the shape, with soft shamoy leather and baked hair. In the palm of the hand there is an iron screw, in which a screw-nail is occasionally fastened. The head of this nail is a spring-plate, contrived in such a manner as to hold a knife or a fork, which it does with perfect firmness. And by means of a brass ring fixed on the first and second fingers, a pen can be used with sufficient exactness for writing.

When only a hand and fore-arm is needed, it is fixed to the arm above the elbow by a strap of leather sowed to one of the sides of the artificial fore-arm. After making a turn and a half just above the elbow, the strap is fixed on the back part of the limb at *D*, fig. 2.

When the arm is amputated above the elbow, the artificial limb is made with an elbow-joint. This part of it is made of wood,



wood, and has a rotatory motion as well as that of flexion and extension.

I have given this particular account of Mr Wilson's invention, from a conviction of its being superior to any with which the public is acquainted: I am also pleased at having it in my power to let the merit of such an artist be more generally known than it otherwise might be. Indeed his merit in matters of this kind is so conspicuous, as well as in the management of distorted limbs, that his death I would consider as a public loss, at the same time that I have often wished that some public encouragement were given him, to enable him to communicate as much as possible the result of his experience to others.

PLATE LXXXVIII.

[Opposite to page 445.]

In this plate I have delineated two machines for supporting the head and shoulders, commonly employed in distortions of the spine.

Fig.

Fig. 1. *A*, An iron collar properly covered for passing round the neck. By means of the long iron plate connected with it, it may be raised or depressed at pleasure. *BBB*, A broad iron plate fitted to the back and shoulders. *CC*, Two straps to be carried over the shoulders; and being brought through beneath the arm-pits, to be fixed, of a sufficient tightness, on two knobs on the shoulder-plates, as may be seen in fig. 2. *D*, A strap for fixing the plate going down the back, by being tied round the body.

Fig. 3. An iron or steel instrument, delineated by Heister for the same purpose with the preceding. *AA*, Its transverse part, to which are fastened iron rings *CC* for retaining and keeping back the shoulders. *B*, The perpendicular part going down the back. *D*, A band or ligature passing through an aperture in the lower end of the plate *B* for tying it firmly to the body.

PLATE

## PLATE LXXXIX.

[Opposite to page 449.]

In this and the four following plates I have delineated the instruments employed in midwifery.

The forceps is perhaps the best, as it is the safest, instrument employed by the Accoucheur.

Various forms of it have been recommended by practitioners; but the one delineated in this Plate has been found to answer perhaps better than any other. It appears to be sufficiently long, and the blades apply with perfect exactness to the child's head.

This instrument should measure eleven or twelve inches in length. Some have alleged that they should be longer, in order to prevent their locking within the vagina, and that they may with more ease be applied when the head of the child lies high in the pelvis; but the

I

length



length we have mentioned is by experience found to be sufficient.

PLATE XC.

[Opposite to page 452.]

Fig. 1. A single blade of the common crotchet: An instrument employed for tearing away the foetus piece-meal when it cannot be delivered entire. From the form of this instrument, it is obvious that it cannot be used but with much risk even of hurting the mother. The best rule for preventing this is to keep the point of it always towards the foetus.

Fig. 2. The two blades of the crotchet locked together; in which way they may be used with perfect safety to the mother.

Fig. 3. Scissars used for perforating the skull of the foetus, where the pelvis is so narrow that delivery cannot be otherwise accomplished. After emptying the cranium of its contents, the child is extracted piece-meal either with the crotchet or with the blunt-hook, fig. 2.

Plate XCI. or with the forceps, figure 1. or 3. of the same Plate.

The scissars here represented are those recommended by Doctor Denman.

### PLATE XCI.

[Opposite to page 456.]

The forceps, figures 1. and 3. as well as the blunt-hook, figure 2. of this Plate, are intended, as was mentioned in the explanation of the preceding Plate, for extracting the foetus piece-meal, when it has been judged proper to accomplish delivery in this manner.

### PLATE XCII.

[Opposite to page 459.]

The instruments in this Plate, and the fillet fig. 3. in Plate XCIII. are the invention of my friend Sir Thomas Bell, a practitioner of eminence in Dublin. They are chiefly intended for extracting the head of the foetus, when by accident or improper management it is separated  
from

from the body in cases of narrow pelvis.

By a proper application of the fillet just mentioned, he fixes the head steadily till it be sufficiently opened for discharging the brain; when by means of the forceps here delineated, he performs the extraction. These forceps consist of two blades; one nearly of the ordinary form; the other convex: and its convexity being adapted to the concavity of the other, the two occupy much less space than they otherwise would do; by which they are peculiarly well fitted for the narrow pelvis we are now speaking of. The teeth with which one of the blades is furnished, give these forceps a very firm hold of any part to which they are applied: And as it is an instrument that may be used with safety, I think it probable that it may in many cases supersede the use of the crotchet.



## PLATE XCIII.

[Opposite to page 462.]

Fig. 1. A fillet of whale-bone covered with a sheath, which by some operators is employed, in cases of difficult labour, for pulling down the head of the foetus. In general, however, the forceps is preferred to it.

Fig. 2. A curved instrument, with an opening at one end, for applying ligatures round polypous excrescences in the uterus. It is the invention of the late Doctor Hunter of London, and it answers the purpose in the easiest and most effectual manner.

Fig. 3. A fillet mentioned in the explanation of the preceding plate as the invention of Sir Thomas Bell of Dublin: It is a material improvement of the common fillet represented in figure 1. of this Plate.

PLATE



PLATE XCIX.

FIG. 1.



FIG.

2.

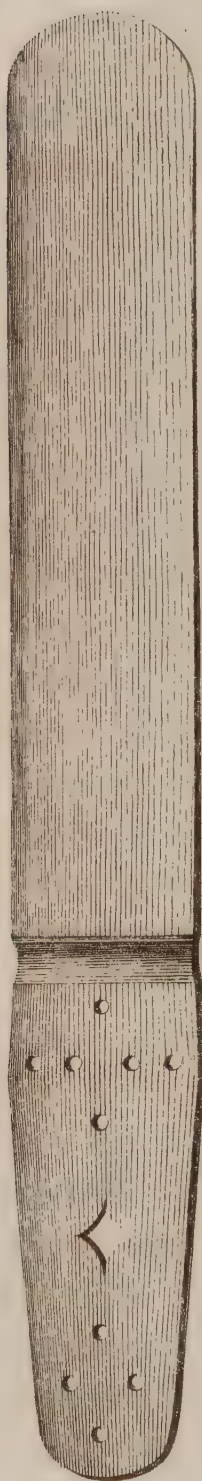


FIG. 3.

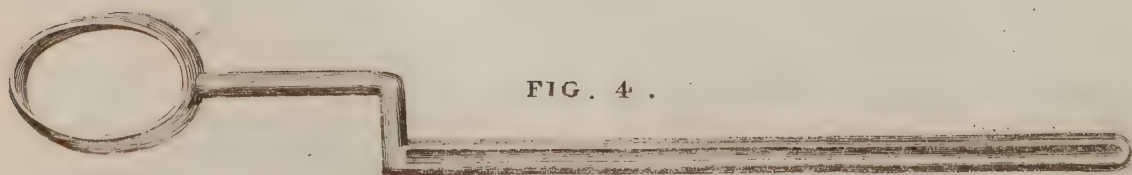


FIG. 4.



## PLATE XCIV.

[Opposite to page 473.]

Fig. 1. I have here delineated a night-cap, fixed in such a manner as to serve as one of the best bandages for the head.

Fig. 2. The common triangular napkin, or couvre-chef of the French, usually employed as a bandage for the head.

Fig. 3. The radiated bandage, as it is usually termed. It is commonly employed for compressing the temporal artery; and it will answer equally well for stopping hemorrhagies in any arteries of the head, as may be seen in fig. 4. where the knot or turn is made at the angle of the jaw.

Fig. 5. The bandage usually employed for fractures of the lower jaw, as well as for wounds and other injuries of the under lip and chin. The method of applying it is mentioned in page 475.

Fig. 6. A bandage for supporting the head. It is formed by a proper appli-

cation of the double-headed roller, fig. 2.  
Plate XCV,

PLATE XCV.

[Opposite to page 476.]

Fig. 1. A common single-headed roller; a bandage that answers for various purposes in surgery.

Fig. 2. A double-headed roller.

Fig. 3. A double-headed roller with a slit in the middle, forming what is termed the Uniting Bandage.

Fig. 4. A four-headed roller, usually employed for fractures of the lower jaw and other affections of the contiguous parts.

Fig. 5. A bandage with twelve heads or tails applied to a leg. This, as we have had occasion to observe in various parts of this work, is the most useful bandage for fractures, as well as for many other affections of the thighs and legs. In fig. 7. I have represented a bandage of the same kind, made in a  
manner

manner commonly used in some of the London hospitals.

Fig. 6. The uniting bandage, fig. 3. applied to a wound in the arm.

### PLATE XCVI.

[Opposite to page 478.]

Fig. 1. and 2. A front and back view of the napkin and scapulary bandage; the most useful bandage for almost every part either of the thorax or abdomen. The particular parts of it, and mode of applying it, have been already described, page 478.

Figures 3. and 4. different forms of the T-bandage. This bandage proves particularly useful in affections of the anus and perineum. *C*, A hole for admitting the penis. At *D*, that part of the bandage which passes between the legs is divided into two; one part of it passing on one side of the penis and scrotum, and the other on the opposite side.



## PLATE XCVII.

[Opposite to page 480.]

In this Plate I have delineated the different forms of suspensory bandages for the scrotum. They may be made either of linen, cotton, or flannel; but soft cotton answers best.

Each bandage consists of a circular *A*, which is fixed round the body above the bones of the pelvis, and a pouch or bag connected with this: The principal difference between them consists in the form of the pouch, and in the manner by which it is fixed to the circular. In figures 1. 2. 3. and 4. the pouch is connected with the circular both before and behind. Of these, fig. 3. I think is the best.

Where the scrotum is of such a size, that the pouch or bag, when fixed upon it, will remain, the two bands, which pass between the thighs for fixing it behind, are unnecessary: Fig. 5. represents a form of it for this purpose.

PLATE

## PLATES XCVIII. and XCIX.

[Opposite to pages 528. and 529.]

In these two Plates I have delineated instruments for a pocket-case, which surgeons have daily occasion for.

PLATE XCVIII. fig. 1. Forceps. Fig. 2. A round edged scalpel. Fig. 3. Crooked scissars. Fig. 4. A case for caustic and red precipitate.

PLATE XCIX. fig. 1. and 3. Different forms of probes. Fig. 2. A spatula. Fig. 4. A director.

These, with a probe-pointed bistoury, fig. 2. Plate VII. a tenaculum, Plate I. fig. 1. a scarificator, Plate XLIX. fig. 4. and a few crooked needles of different sizes, form a very complete set for a pocket-case.

F I N I S.

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